Acoustics 2014 Mysuru

National Symposium on Acoustics
"Acoustics for better Speech"
12 - 14 November, 2014

All India Institute of Speech and Hearing, Mysuru

Organized by

Acoustical Society of India (ASI)

&

All India Institute of Speech & Hearing, Mysuru

Venue

All India Institute of Speech & Hearing

Manasagangothri, Mysuru - 570 006

SOUVENIR

ORGANIZERS

ACOUSTICAL SOCIETY OF INDIA (ASI)

The Acoustical Society of India was established and registered at Visakhapatnam on 31 July, 1971 with Prof. S. Bhagavantam as the Convener, Prof. B. Ramachandra Rao as the Secretary and 10 other leading acousticians of the country as ad-hoc Committee members. The decision to bring together the scientists working in various fields of acoustics all over the country under one umbrella and to publish a scientific journal devoted to Acoustics was taken in a symposium on 'Acoustics in Education' organized at the Andhra University, Waltair during January, 1971 under the stewardship Prof. B. R. Rao. Thus, the Acoustical Society was formed with the following objectives:

"The advancement of science and technology of all branches of acoustics and the maintenance of high standards in such science and technology; to increase and diffuse the knowledge of acoustics and promote its practical application".

The above objectives are to be achieved by publishing a professional journal, periodic newsletters, status reports and by organizing conferences, symposia and seminars in various branches of acoustics. Yet other objectives of the society include co-operation with similar allied societies both in India and abroad and representing acoustical interests at the National and International levels. It is an active member of the International Commission on Acoustics (ICA) which is associated with International Union of Pure and Applied Physics (IUPAP).

A full text of the Memorandum of Association and Rules and Regulations of the Society as initially formulated was published in the first issue of the Journal of Acoustical Society of India (JASI) Vol.1, No.1, January, 1973. A revised version of the above information was published as a booklet in September, 1982.

Thus, the society was formulated to have Prof. S. Bhagwantam as its founder President, Dr. M. Pancholy as Vice-President and Chief Editor of JASI and Prof. B. R. Rao as Secretary and Treasurer. Other eminent acousticians associated with the growth of the society to its present status were Prof. B. S. Ramakrishna, Prof. S. K. Kor, Prof. Rais Ahmed, Dr. D. Srinivasan, Prof. T. Seshagiri Rao, Prof. E. S. R. Gopal, Prof. S. Kameswaran, Shri. K. D. Pavate, Dr. S. S. Agrawal, Late Shri. M. S. Narayanan, Prof. M. L. Munjal, Dr. V. K. Aatre, Dr. S. P. Singal, Prof. B. V. A. Rao, Prof. S. Narayanan, Prof. G. M. Srinivasan, Prof. B. V. A. Rao and Prof. V. Bhujang Rao and a number of acousticians in the country.

ORGANIZERS

ALL INDIA INSTITUTE OF SPEECH AND HEARING (AIISH)

The All India Institute of Speech and Hearing was established in the year 1965 as an autonomous institute fully funded by the Ministry of Health and Family Welfare, Government of India. The major objectives of the institute are to impart professional training, render clinical services, conduct research and educate the public on issues related to communication disorders such as hearing impairment, mental retardation, voice, fluency and phonological and language disorders. The institute started with one post-graduate program in the year 1965 and now offers many courses including Certificate course, Diploma programs (Diploma in Hearing Aid & Earmould Technology, Diploma in Training Young Hearing Impaired Children and Diploma in Hearing Language and Speech-through distance mode); undergraduate programs (B.Sc. in Speech & Hearing and B.S.Ed - Hearing-Impairment); PG Diploma programs in Clinical Linguistics and Forensic Speech Science and Technology; post-graduate courses (M.Sc. in Audiology, M.Sc. in Speech-Language Pathology and M.S.Ed-Hearing-Impairment). The Institute offers Ph.D programs in Audiology and Speech-Language Pathology and also Post-Doctoral Fellowships.

AIISH caters to clients of all ages having a whole range of communication disorders. The institute attracts students from all over India and abroad. It has strived in the past 49 years and stepped into 50th year in furthering the cause of professions of Audiology, Speech-Language Pathology and Special Education throughout the country. The enthusiasm to excel in reaching out to individuals with communication disorders knows no boundaries. The institute has been recognized as a Center of Excellence in the area of Deafness by WHO, as a Centre for Advance Research by UGC and as a Science and Technology Institute by DST. The institute has now been recognized as a Nodal Center for the implementation of National Program for Prevention and Control of Deafness of Ministry of Health and Family Welfare, Government of India as well as for generating man power for the same. The institute is recognized as a ***Center of Excellence*** and also accredited by NAAC with "A" Grade and certified with ISO 9001: 2008 certification.

AIISH is wholly financed by the Government of India and functions as an autonomous organization under the direction of the Executive Council with the Hon'ble Union Minister of Health and Family Welfare as Chairman and the Hon'ble Minister of Health and Family Welfare, Government of Karnataka as the Vice Chairman.

AIISH is committed to bring out quality professionals who can meet the challenges of helping individuals to overcome the debilitating effects of their communication disorders. We hope to set new standards so that future trained professionals are always on their toes to succeed. We are sure that our students will make us and the country proud.

COMMITTEES

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University of Mysore

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Dr. Sujeet Kumar Sinha, Co-Convener

Ms. Priya M. B., Co-Convener

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CEO, Voice & Speech Systems, Bengaluru

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Honorary Prof. & Convenor,
FRITA, IISC, Bengaluru

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Research Academy, Kolkata

Dr. AshaYathiraj
Prof, Dept. of Audiology
AIISH, Mysuru

Dr. K. Boommana Raja
Prof, PSNA College of Engg. & Technology,
Dindigul

EXECUTIVE COUNCIL - ASI

ACOUSTICAL SOCIETY OF INDIA
OFFICE BEARERS FOR THE TERM 2010-2014

President	**Dr. V. Rajendran** Director, Research & Development and Centre for Nano Science and Technology K. S. R. Group of Institutions K.S.R.Kalvi Nagar, Tiruchengode - 637 215, Namakkal (Dt.) Tamil Nadu. Tel No.: +91- 4288-274880, Fax: +91- 4288-274880 E-mail: veerajendran@gmail.com
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MESSAGE

The Acoustical Society of India (ASI) since its inception is driving hard to advance the science and technology of acoustics in India through various events like International/National conferences, workshops on recent emerging topics, research paper publications through its journal, etc. In the recent years, ASI joint hands with the international Acoustical societies in organizing the conferences and events. Last year, we have organized ACOUSTICS - 2013, Indo-France conference at National Physical Laboratory (NPL), New Delhi, in association with the French Acoustical Society (SFA), France. The National Symposium on Acoustics is an annual event of ASI conducted every year which acts as a platform to provide opportunity for future collaborations in different fields such as Sound and vibrations, Acoustic Engineers, Bio-medical Engineers, Speech and Hearing etc. I am very happy to note that this year NSA is organized by the All India Institute of Speech and Hearing (AIISH) on the eve of its 50th year of celebrations at the garden and temple city of Mysuru.

On behalf of the ASI and my own personal behalf, I extend a warm greetings and heartfelt thanks to Chairman Dr. S. R. Savithri, Convener Prof. Ajish K. Abraham and all the members of the Organizing team, NSA-2014, AIISH, Mysuru.

I wish the conference a grand success.

Dr. V. Rajendran
President, ASI

INTRODUCTORY NOTE

The All India Institute is happy to host the National Symposium of Acoustics (NSA), 2014 in collaboration with the Acoustic Society of India. The main theme of the National Symposium on Acoustics is ***Acoustics for better speech***. The symposium would provide insight on scientific activities in the area of acoustics in the country and would generate interest in future research in this field. The areas covered in the Symposium include Aero and Hydro Acoustics, Building and Environmental Acoustics, Instrumentation and Signal Processing, Bioacoustics, Physical Acoustics, Speech, Transducers & Electro-acoustics and Vibro-Acoustics and Noise.

The symposium includes exclusive plenary and invited talks by eminent scientists and researchers in the field of acoustics. These sessions would brainstorm to motivate young scientists on carrying out future research through their implications.

The conference is based on several structured sessions organized, chaired and co-chaired for each session. The large number of papers has permitted building up a challenging and exciting program for 3 days: 4 plenary lectures, 3 invited talks and 81 structured oral presentations by professionals in the field. The series of plenary sessions include lectures by distinguished researchers on need for the hour themes such as ***Text- to-speech in Indian Languages*** and ***Structure of stop consonants*** and so on.

The Acoustics 2014, Mysuru would be a beguiling experience for students as well as professionals and would prove to be well co-ordinated with good hospitality and rich scientific experience. The symposium would also include exhibits from various companies supporting the field of acoustics.

As a whole, the National Symposium on Acoustics 2014, Mysuru is promising to produce well-formed scientific evidences and discussions to support the current scientific scenario and encourage future innovations through research in the field of acoustics. This forum would be an amalgamation of interdisciplinary researchers such as the acoustic engineers, speech-language pathologists, audiologists, bio-medical engineers, linguists and significant others.

On behalf of the organizing committee, I wish to thank all the sponsorers and place on record the contribution and hard work of the co-ordinators of various committees of the NSA 2014.

Dr. Savithri. S. R.
Chairperson, NSA 2014

ACKNOWLEDGEMENTS

Our sincere thanks to all the Chairpersons of the local organizing committee for their tireless efforts in successfully conducting Acoustics 2014. We gratefully acknowledge the hard work and dedication put in by each and every member of the respective committees.

The input and guidance of the Advisory Committee is deeply appreciated.

We would like to acknowledge the support provided by Dr. Rajendran, President, Dr. P. V. Ganesh Kumar, Secretary and all EC members of Acoustical Society of India in organizing the symposium.

We gratefully acknowledge all the plenary speakers, invited speakers, Chairs and Co-chairs of all the technical sessions.

Thanks all to the delegates and participants for their effective participation.

We are grateful for generosity and the contributions of all our sponsors, exhibitors and advertisers.

All our colleagues at All India Institute of Speech and Hearing, deserves special appreciation for their responsiveness and support.

A special thanks to all our AIISH students, who have made the cultural evening wonderful.

This souvenir could not have been published without the support, time and devotion of the Chairperson and members of the souvenir committee. We wish to thank Dr. Jayashree C Shanbal and her team for their relentless efforts.

Our deep felt gratitude to our Chairperson Dr. S.R. Savithri, Director, AIISH for her indispensable supervision, guidance and support. A sincere thanks to each and everyone for ensuring the success of Acoustics 2014.

Prof. Ajish K. Abraham
Convener - Acoustics 2014

PROGRAM AT A GLANCE

12.11.2014

9.30 - 11.00	Inaugural Session
11.30-12.00 **Plenary Session I**	Chair - Dr. E.S. R. Gopal, IISc, Bengaluru Speaker - Dr. Hema Murthy, Professor, Dept. of C.S., IIT, Chennai
12.00-12.30 **Plenary Session II**	Chair - Dr. E.S. R. Gopal, IISc, Bengaluru Speaker - Dr. Nachiketa Tiwari, Associate Professor, IIT, Kanpur
12.30-12.45	**M.S. Narayanan Memorial Lecture** Dr. E. Jasmine Vasantharani
12.45-13.00	**Rais Ahmed Memorial Lecture** Dr. B. Rajashekar
Session I 14.00-15.30 Instrumentation & Signal Processing	Chair - Dr. Hema Murthy, IIT Chennai Co-chair - Dr. Udhaya Shankar, SJCE, Mysuru Invited Talk – Dr. Manell Zakharia
Session II 15.45-17.00 Aero, Hydroacoustics, Building and Environmental acoustics	Chair - Dr. Nachiketa Tiwari, IIT Kanpur Co-chair – Dr. B.K. Sridhara, NIE, Mysuru Chair - Dr. M. L. Munjal, IISc, Bengaluru Co-chair- Dr. Srinidhi, Prof- Dept. of Mechanical Eng., SJCE, Mysuru

13.11.2014

9.00-9.30 Plenary Session III	Chair- Dr. S. S. Agrawal, Past President, ASI Speaker - Dr. M. L. Munjal, Honarary Professor, IISc, Bengaluru
Session III 9.30-12.30 Vibro-Acoustics & Noise	Chair - Dr. M. L. Munjal, IISc, Bangalore Co-chair - Dr. R. Srinidhi, Prof. Dept. of Mech. Engg., SJCE Mysuru
Session IV 13.30-15.45 Physical, Underwater & Ultrasonics	Chair - Dr. P. V. Ganesh Kumar, NSTL, Vishakhapatnam Co-chair - Dr. S. V. Nayakulu, GNITC, Hyderabad Invited Talk – Dr. K.P.B Moosad, Dy. Director, NPOL, Kochi
Session V 16.00-17.30 Transducers, Electro and Bio-acoustics	Chair - Dr. Mahavir Singh, NPL, New Delhi Co-chair - Dr. Bommanna Raja, PSNACE, Dindigul

PROGRAM AT A GLANCE

14.11.2014

9.30-10.00 Plenary Session IV	Chair - Dr. S. R. Savithri, Director, AIISH, Mysuru Speaker - Dr. T.V. Ananthapamanabha, CEO, VSS, Bengaluru
Session VI 10.00-12.30 Speech	Chair - Dr. T.V. Ananthapadmanabha, VSS, Bengaluru Co-chair - Dr. N. Sreedevi, AIISH, Mysuru Invited Talk – Dr. Prakash B., Professor, SRMC, Chennai
Session VII 13.30-15.00 Sound Perception	Chair - Dr. Asha Yathiraj, AIISH, Mysuru Co-chair - Dr. Ajith Kumar. U, AIISH, Mysuru Invited Talk – Dr. C.S. Vanaja, Professor, Bharathi Vidyapeet, Pune
Session VIII 15.15-16.30 Musical Acoustics	Chair - Dr. K. P. B. Moosad, Dy. Director, NPOL, Kochi Co-chair - Dr. Prakash B, SRMC, Chennai

LIST OF SESSIONS

AH:	Aero & Hydro Acoustics, Building and Environmental Acoustics
ISP:	Instrumentation and Signal Processing
MA:	Musical Acoustics
PA-UW-UL:	Physical Acoustics, Underwater Acoustics and Ultrasonics
SP:	Speech
SDP:	Sound perception
TEA:	Transducers, Electro-Acoustics and Bioacoustics
VN:	Vibr-Acoustics and Noise

TECHNICAL PROGRAMME SCHEDULE

12.11.2014 (WEDNESDAY)

9.30 -11.00	**INAUGURATION**	
11.00-11.30	**HIGH TEA**	
11.30-12.00	PLENARY SESSION I	Chair - Dr. E.S. R. Gopal, IISc, Bengaluru Speaker: Dr. Hema Murthy, Professor Department of Computer Science, IIT, Chennai *Text to Speech Synthesis in Indian Languages*
12.00-12.30	PLENARY SESSION II	Chair - Dr. E.S. R. Gopal, IISc, Bengaluru Speaker: Dr. Nachiketa Tiwari, Associate Professor, Dept. of M.E. IIT, Kanpur *Structure of Stop Consonants*
12.30-12.45	M.S. Narayanan, Memorial Lecture - Dr. E. Jasmine Vasantharani	
12.45-13.00	Rais Ahmed, Memorial Lecture - Dr. B. Rajashekar	
13.00-14.00	**LUNCH**	
14.00-15.30	SESSION I **Instrumentation & Signal Processing**	Chair - Dr. Hema Murthy, Professor Department of Computer Science, IIT, Chennai Co-chair - Dr. Udhaya Shankar, SJCE, Mysuru
	INVITED TALK	Speaker: Dr. Manell E. Zakharia, International Technical Expert, French Embassy in India and Project Officer, IIT Jodhpur *Quantitative Imaging Using Surface Acoustic Waves*
	ORAL PRESENTATIONS	Hand talk assistive technology for deaf and dumb
		Visual Text Aided System for Sign Language
		Development of a Pure Tone Screener
		Application of automatic speech recognition in communication sciences and disorders
		Acoustic Emission Studies on weld defected Nuclear grade materials
15.30-15.45	**TEA**	
15.45-17.00	SESSION II **Aero, Hydroacoustics Building & Environmental Acoustics**	Chair - Dr. Nachiketa Tiwari, IIT Kanpur Co-chair - Dr. B. K. Sridhara, NIE, Mysuru
	ORAL PRESENTATION	Fan noise Source Characterization using NAH Methods

TECHNICAL PROGRAMME SCHEDULE

12.11.2014 (WEDNESDAY)

15.45-17.00	ORAL PRESENTATIONS	Rib optimization for maximize the Stiffness of marine engine foundation
		Effect of temperature and humidity on sound absorption measurements in a Reverberation chamber
		Studies on the acoustical design and performance of an auditoria
		Acoustical characterization of live music and singing in nossa senhora do pilar church, Goa
17.30-18.30	**GENERAL BODY MEETING OF ASI**	
18.30-19.30	**CULTURAL PROGRAM FOLLOWED BY BANQUET**	

13.11.2014 (THURSDAY)

9:00-9:30	PLENARY SESSION III	Chair- Dr. S. S. Agarwal, Past President, ASI Speaker: Dr. M. L. Munjal, Honarary Professor IISc, Bengaluru. *Enhancing Speech To Noise Ratio Through Advanced Techniques of Noise Control*
9:30-11:00	SESSION IV **Vibro-Acoustics & Noise**	Chair- Dr. M. L. Munjal, Honorary Professor, IISc, Bengaluru. Co-chair - Dr. R. Srinidhi, SJCE, Mysuru.
	ORAL PRESENTATIONS	Optimization of Energy Harvesting from Nonlinear Dynamic Vibration Absorbers.
		Acoustical Performance of Rubber Crumb Material
		An analysis of weakly nonlinear acoustic wave propagation in fluid-filled isotropic and orthotropic cylindrical shells with and without periodic supports
		Sensitivity analysis for CLF of line connected and point connected systems
11.00-11.15	**TEA**	
11.15-12.30	SESSION IV CONTINUED	Chair- Dr. M. L. Munjal, Honarary Professor, IISc, Bengaluru. Co-chair - Dr. R. Srinidhi, SJCE, Mysuru.
	ORAL PRESENTATIONS	Optimization of Sheet Metal Panel Geometric Features for Effective Noise Control

TECHNICAL PROGRAMME SCHEDULE

13.11.2014 (THURSDAY)

11.15-12.30	ORAL PRESENTATIONS	3-D FEM as well as 1-D Analysis of a Three-Pass Double-Reversal Muffler
		Prediction of Non-Cavitating Noise of an Optimized Marine Propeller
		Self-radiation efficiency of vibration modes of a heated isotropic plate
		Flow-Acoustic Analysis of the Three-Chamber Same-End Inlet-Outlet Muffler with Perforated Baffles
12.30-13.30	**LUNCH**	
ھڻ‌ی‌و-15.30	{9{{Ih b Ië **Physical Acoustics, Underwater Acoustics & Ultrasonics**	Chair - Dr. P. V. Ganesh Kumar, NSTL Vishakapattanam Co-chair - Dr. S. V. Nayakulu, GNITC, Hydrabad
	Ib ë IÇ95 Ç! [Y	Speaker: Dr. K.P.B. Moosad, Dy. Director, NPOL, Kochi *Acoustic Diver Deterrence*
	h w! [t w9{9b Ç! ÇIh b {	Acoustical Lightweight Partition Design for Residential and Commercial Buildings in India
		Ultrasonic study of molecular interaction In binary mixture of di-n -butyl phthalate (dbp) with polar liquids at different frequencies
		Visco metric, ultrasonic and thermodynamic studies in aprotic-aprotic binary mixture
		Molecular interaction study in dewaxing of crude petroleum oil by ultrasonic technique
		Ultrasonic study of surface treatment of natural fiber with maleic acid blended alcohols
		Acoustic Studies on Polar Extrants with Non Polar Diluents at Different Frequencies
		Ultrasonic and Spectroscopic Studies on Ternary Mixture of Cyclohexanene +2-Ethoxy Ethanol +Ethyl Acetate
		An Analysis of uv-vis Spectra and Thermochemical Parameters of Amides
		Impact of sintering temperature on la0.1ca0.9mno3 perovskite manganite employing ultrasonic studies
		Mechanical properties of gd doped lacro3 perovskite manganite materials
		Phase Transitions of Bulk and Nanocrystalline La1-xpbxmno3 Perovskite Manganite Materials employing Ultrasonic Velocity Measurements
15.30-15.45	**TEA**	

TECHNICAL PROGRAMME SCHEDULE

13.11.2014 (THURSDAY)

15.45-17.30	SESSION IV CONTINUED	Chair - Dr. P. V. Ganesh Kumar, NSTL Vishakapattanam Co-chair - Dr. S. V. Nayakulu, GNITC, Hyderabad
	ORAL PRESENTATIONS	Synthesis and Online Ultrasonic characterization of catil-x fero 3 complex Nano Perovskite
		Characterization of Bulk and Nano La1-xnaxmno3 Perovskites employing In-situ Ultrasonic measurements
		Role of environment on cross-channel acoustic propagation in the Kochi estuary - a case study
		Ultrasonic Velocity, Viscosity and Density of Alcohol+Triethylamine+Acetic acid Mixture at Different Temperature
		Mid-to-high frequency (6-12 kHz) acoustic bottom backscattering from littoral seabeds
		Study of solvation and sonochemical effect on pani non-aqueous solution using ultrasonic velocity
		Compatibility and activation energy studies of blends of PMMA 350000 in 1,4 Dioxane by Ultrasonic and related techniques
		A study of adiabatic compressibility and solvation number of peptides in non-aqueous medium. (A study of acoustic and solvation properties of Glycyl salts in non-aqueous solution)
17.30-18.30	SESSION V **Transducers, Electroacoustics and Bioacoustics**	Chair - Dr. Mahavir Singh, NPL, New Delhi Co-chair - Dr. Bommanna Raja, PSNACE, Dindigul, Tamil Nadu
	ORAL PRESENTATIONS	Ray analysis of embedded solid circular cylinder excited by a plane acoustic wave
		Analytical model of an array of Langevin transducers including acoustic interaction effects
		Correlation of Objective and Subjective data of Automotive Horn
		Detrended fractal analysis of EEG signals with music stimuli of contrast emotions
		Assistive Technology to Override Poor Acoustics for Museum Visitors with Hearing Impairment

TECHNICAL PROGRAMME SCHEDULE

14.11.2014 (FRIDAY)

9.30-10.00	PLENARY SESSION IV	Chair- Dr. S. R. Savithri, Director, AIISH, Mysuru. Speaker: Dr. T.V. Ananthapamanabha, CEO, Voice & Speech System, Bengaluru. *Gaps In The Acoustic Theory Of Speech Production*
10.00-11.30	SESSION VI **Speech**	Chair - Dr. T.V. Ananthapadmanabha, CEO, Voice & Speech System, Bengaluru. Co-chair - Dr. N. Sreedevi, Reader and Head Department of SLS, AIISH, Mysuru.
	INVITED TALK	Speaker: Dr. Prakash Boominathan, Professor Department of Speech language and Hearing Sciences, SRMC Chennai, Tamil Nadu. *Some Acoustic Aspects Of Carnatic Singing*
	ORAL PRESENTATIONS	Voice characteristics in street children (vendors)
		Rate of speaking & reading of adult Nepali speakers
		Voice parameters of children with Down syndrome using multi-dimensional voice program
		Acoustical & Perceptual effect of age & gender on voice of individuals between 4 to 18 years
		Benchmark for speaker identification using linear prediction cepstral coefficients (LPCC) on vowels in Kannada language: a preliminary study
		F0 Characteristics of Professional News-readers in Context of Varied Emotional News Items
		Acoustic analysis of voice in microlaryngeal phonosurgery among vocal polyp patients
11.30-11.45	**TEA**	
11.45-12.30	SESSION VI CONTINUED	Vowel acoustics in surgically treated oral carcinoma
	ORAL PRESENTATIONS	Perception of native and non-native phonemes by Malayalam listeners
		Voice onset time (VOT) in Malayalam speaking children with autism spectrum disorders
		Transition of co-articulation from prelinguistic to early linguistic period
12.30-13.30	**LUNCH**	

TECHNICAL PROGRAMME SCHEDULE

14.11.2014 (FRIDAY)

13.30-15.00	SESSION VII Sound Perception	Chair- Dr. Asha Yathiraj, Professor Department of Audiology, AIISH, Mysuru. Co-chair- Dr. Ajith Kumar U, Reader and Head Department of Audiology, AIISH, Mysuru.
	INVITED TALK	Speaker: Dr. C. S. Vanaja, Professor Bharathi Vidya Peet, Pune. *Electro- Physiological Measures In Understanding Sound Perception*
	ORAL PRESENTATIONS	Brainstem encoding of dynamically changing virtual pitch in harmonic complexes
		Comparison of the effective compression ratio and the nominal compression ratio in hearing aids
		Neural representation of different speech stimuli at cortex in individuals with normal hearing
		Cognitive processing and peripheral sensory coding in individuals with normal hearing sensitivity
		Age Related Differences in Some Psycho acoustical abilities, Speech Perception in Noise and Working Memory
		Fast Fourier Transform analysis of speech processed at sub cortical level in children at risk for central auditory processing disorders
		Processing of easy and difficult phonetic contrasts by native listeners: A P300 study
15.00-15.15	**TEA**	
15.15-16.30	SESSION VIII Musical Acoustics	Chair - Dr. K.P.B. Moosad, Dy. Director NPOL, Kochi. / ◘-chair - Dr. Prakash B, Professor, Department of Speech language and Hearing, SRMC, Chennai.
	ORAL PRESENTATIONS	Identifying emotions through ragas: an exploratory study
		Acoustical Signature Analysis of Voen
		Acoustic and material characterization of syahi used in the Indian percussion instrument Tabla
		Timbral differentiation of western and Indian style violin sounds
		Effect of reverberation on acceptable noise level under different background conditions
		Effect of short term musical training on auditory cortical responses
16.30-17.30	**VALEDICTORY**	

MEMORIAL LECTURES

M. S. NARAYANAN MEMORIAL MEMORIAL LECTURE

ULTRASONICS AND ITS NOVELTIES IN THE LIQUID STATE REGIME

Dr. E. Jasmine Vasantha Rani
Research Advisor in Physics and Assistant Controller of Examinations

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The study of intermolecular interaction has attracted the attention of many workers. Various theories had been proposed to study and understand the entire field of liquid state. The unique behavior of liquid state is interesting for the scientific community. For these reasons the understanding of their properties at the molecular level is of foremost interest in many fields of science and engineering. Ultrasonic velocity is an important technique existing in understanding the varies interactions occurring in liquids and solutions. It confirms the presence of electrostatic interactions, dipole-dipole interactions, inter and intra molecular interactions and also hydrogen bond formations. These information help in elucidating the molecular structures existing in the liquid medium with the help of spectroscopic techniques. Nowadays sonication is considered one of the most powerful tools in the synthesis of nanomaterials. In comparison with traditional sources of energy, ultrasounds ensure unusual reaction conditions in liquid phase reactions due to the cavitation phenomenon. Photodeposition as well as sonication method are well known and used independently in the synthesis of nanomaterials. Syntheses of Polymeric Nanofluids are studied in solutions by passing ultrasonic velocity in Cu-PVP colloids. In the past decade, several methods have been developed that yield exquisite control over both the size and shape of inorganic and metal nanoparticles in solutions. At present sonication is playing a prime role in the preparations of nanomaterials. It is reported that in literature reprecipitation in conjunction with sonication provides an efficient way to synthesize organic nanoparticles and also by controlling the duration of sonication, one can control both the size distribution and crystallinity of the particles. From our research lab, more than hundreds of liquid samples (aqueous and non-aqueous solutions of electrolytes, polymers, ionic liquids, surfactants, proteins etc.) have been studied and the results are reported using ultrasonic velocity. Nanoparticles are also prepared from non- aqueous doped PANI aniline solutions by controlling the sonication time and temperature. This novel approach helps in growing bigger size of the single crystals by passing sonications.

RAIS AHMED MEMORIAL LECTURE

ROLE OF ACOUSTICS IN THE ASSESSMENT & INTERVENTION OF COMMUNICATION DISORDERS

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The area of Speech Sciences dealing with the acoustical characteristics of speech has developed over the last two decades & plays a stellar role in the assessment & remediation of communication disorders. The study of speech acoustics involves both the physical& psychological sides: physical, pertaining to the physical structure of the sounds of speech &psychological, with the perception of these sounds. Speech and voice disorders, and their impact on quality of life, are attracting more interest in today's communication based society. This brings the need for an objective definition of normal and abnormal findings obtained during patient examination. In this context, objective acoustic analysis has become an indispensable tool. Acoustic analysis of speech, starting with older non-digital methods has come a long way to the power of modern computer applications. Further, there has been progress in analyzing &understanding of the singing voice, relevant to SLPs treating professional speakers & singers. Multilingual Speech Processing, acoustics in classrooms& workplace are other areas of relevance to the Speech & Hearing professionals.

PLENARY SESSIONS

PLENARY TALK 1 - TEXT TO SPEECH SYNTHESIS IN INDIAN LANGUAGES

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In this paper, a consortium effort on the development of text-to-speech synthesis systems for Indian languages is presented. The synthesizers are built around the concatenative speech synthesis framework and statistical parametric synthesis framework. For concatenate speech synthesis, unlike conventional cluster-unit synthesis systems where the units are primarily phones or diphones, in this paper, a syllable-based cluster unit is chosen. For the statistical parametric framework, a pentaphone is used with the initial phone models obtained from the corresponding the syllables obtained using concatenate speech synthesis. This is primarily because Indian languages are syllable-timed and the prosodic context across phones is well preserved within the syllable. Even when the prosody does extend across syllables, the rules are simple compared to that of phones or diphones. Indian languages are in general low resource languages, in that there is hardly any transcribed data available. Further, large vocabulary speech recognition systems do not exist for Indian languages. For ease of segmentation a hybrid tool that uses both signal processing and machine learning is developed to obtain syllable boundaries and accurate phone boundaries. Third party MOS evaluation indicates an average score that is above 3 for most of the Indian languages. Thirteen Indian languages are considered in this paper.

PLENARY TALK 2 - ACOUSTIC STUDY OF NON NASAL STOP CONSONANTS

Nachiketa Tiwari

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Our pronunciations of stop consonants vary markedly with age, gender, accent, etc. Yet by extracting appropriate cues common to these varying pronunciations, we can correctly identify the spoken consonant. Stop consonants are a particular class of consonants which involve momentary blockage of air in oral cavity. These consonants are used in all languages. The Devanagari alphabet system contains velar, palatal, retroflex, dental and labial stop consonants in all combinations of presence and absence of aspiration and voicing, which makes it one of the richest collection of stops. Research has already been conducted to find the fundamental nature of these stop consonants, but a full *recipe* of these consonants which can be used to synthesize the pure stop burst sound, is still unknown. Here we present the fundamental structure of these stop burst sounds as well as the aspiration and voicing, in signal domain. This study shows what are the essential and basic cues of a stop consonant our mind searches for, while perceiving it as it is, no matter who speaks it- a man, a woman, a child etc. Our study demonstrate how four basic sounds and two functions of aspiration and voicing can be used to generate the entire non nasal stop consonant matrix of Devanagari alphabet comprising of twenty sounds. In this sense, the Sanskrit term *vyanjan*, for consonants is perhaps a very apt one, as preparation of a vyanjan requires a recipe. Also, we note that since most of the world's languages, including English, use consonants which are subsets of the taken alphabet system, our result has very general applications. The fundamental psychoacoustic cues of stops turn out to be surprisingly simple signals and this result can be used in several speech processing and data transfer algorithms.

PLENARY TALK 3 - ENHANCING SPEECH TO NOISE RATIO THROUGH ADVANCED TECHNIQUES OF NOISE CONTROL

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Excessive ambient noise adversely affects speech intelligibility. Meaningful conversation in noisy environment puts additional stress on the speaker as well as the listener. The speech to noise ratio can be significantly enhanced by control of the ambient noise. This plenary talk/paper lists different techniques for the

environmental noise control. In particular, it touches upon noise insulation of buildings, reverberation control, suppression of cross-talk through shared ventilation ducts, directed masking, and design of quieter fans, blowers and air handling units (AHUs) of the heating, ventilation and air-conditioning (HVAC) systems. The emphasis is on designing the lecture halls and conference rooms for enhanced speech intelligibility.

PLENARY TALK 4 - GAPS IN THE ACOUSTIC THEORY OF SPEECH PRODUCTION

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Speech technology has demonstrated impressive applications such as low bit-rate speech coding, text-to-speech-synthesis, automatic speech recognition and speaker recognition etc. Such technological applications rely on speech analysis which in turn is based on a model for speech production. A success in these applications gives rise to an impression that we have a scientifically sound model for speech production. In this paper we review the articulatory-acoustics and the source-filter models of speech production and show that there exist gaps in our present knowledge. We propose a holistic approach of speech signal analysis for future research.

INVITED TALKS

INVITED TALK 1 - QUANTITATIVE IMAGING USING SURFACE ACOUSTIC WAVES

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Most of acoustic imaging systems make use of P waves for building up images. Those systems are highly blurred with the echoes of the interface when sub-interface imaging is concerned. Surface waves are generated and propagate along the interface. Their energy is guided on a layer of about a wavelength below and above the interface. They can thus be used as a carrier of information from below to above the interface. Two types of waves are described in this paper: Stoneley-Scholte Waves (SSW, marine environment) and Rayleigh Waves (RW, land environment). Their properties will be investigated in details, in particular: penetration, reflexion and refraction and velocity dispersion. Inversion procedure using SSW waves will be presented and applied to scaled tank experiments. Refraction and reflection of SSW waves will also be studied experimentally. Taking into account the results of these investigations tomography algorithms as well as sector-scan imaging will be investigated on mock-ups. Several applications will be presented on real scale: estimation of marine sediment properties using SSW, detection of caves using RW and detection of land mines using RW. For each case, experimental set up will be described in details and in situ results will be shown.

Key words- Stoneley-Scholte waves, Rayleigh waves, surface waves, sonar, velocity dispersion, inversion, tomography.

INVITED TALK 2-ACOUSTIC DIVER DETERRENCE

S. Anantha Narayanan and K.P.B. Moosad

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Increased activities of extremist forces have been a cause of concern worldwide. One particular threat scenario which has been worrying the Navies is the vulnerability of naval vessels and coastal installations to possible attackers reaching their targets through an underwater route, in the form of divers. Detection of divers using Sonar and taking defensive action to neutralize them is one of the strategies adopted, but this has various limitations. Large stand-off zones and long sonar detection ranges are required for enabling the security forces to locate and respond to an intrusion in a timely fashion, which are rarely available. An alternate possibility which has been put into practice by many is to use high decibel underwater acoustic radiations around the vessels/installations that are to be protected from such threats. This acts as an acoustic shield around the protected object, which divers with normal diving equipment cannot penetrate. A lot of studies have been conducted worldwide in this area and there are commercial manufacturers in the west who offer acoustic diver deterrence systems. Although the perceived threat is quite real and relevant for a country like ours, there hasn't been much work in this area. The attention of scientists working in the area of acoustics has not turned to this need of national importance. NPOL has made some forays into diver deterrence and has some experience in the area. However, it is necessary to gather more knowledge on the physiological effects of high decibel underwater sound on human beings before we can effectively use this technique in the field.

INVITED TALK 3 - SOME ACOUSTIC ASPECTS OF CARNATIC SINGING

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Chennai is considered as the cultural capital of south Indian classical Carnatic music. Carnatic singing is a refined fine art with chaste traditional values, and it often requires rigorous training to become a professional singer. Carnatic singing is a popular form that many aspiring singers learn and practice. Among the several essentials for learning and performing Carnatic singing, a healthy vocal apparatus is imperative, just as in case of any vocal art. Aspects of vocal health can be measured using objective physiological and acoustic parameters. This invited talk compiles findings from six different studies on Carnatic

singing conducted at Sri Ramachandra University and a tertiary care medical facility in Chennai over the last decade. The talk will address aspects related to methodology and findings related to (1) singing pedagogy, (2) acoustic parameterization of the nuances in singing including vocal ornaments, (3) physiological interpretations, and (4) vocal health aspects. In conclusion, some directions towards future research in this area will be delineated.

INVITED TALK 4 - ELECTRO - PHYSIOLOGICAL MEASURES IN UNDERSTANDING SOUND PERCEPTION

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Sound perception is a very complex phenomenon. Understanding sound perception through neural encoding is a fascinating study for the scientists. A plethora of studies have been conducted to understand neural encoding of speech which is a complex signal with a number of acoustic features. One of the noninvasive electrophysiological methods to study neural encoding is far field recording of auditory evoked potentials. Electrophysiological measures throw light on neurophysiology of speech perception, both normal and abnormal. These measures have proved valuable in documenting improvement in speech perception with the help of hearing devices and/or with training. Understanding the neural representation of speech in persons with normal auditory system and those with problems in auditory perception can eventually help in developing devices/measures to improve speech perception.

In order to study processing at different levels, brainstem as well as cortical auditory evoked responses, both exogenous and endogenous potentials are used. Some of the potentials that have been found useful in studying speech perception include Frequency Following Responses (FFR), Acoustic Change Complex (ACC), Mismatch Negativity (MMN), P300, N400, P500/600. Auditory evoked potentials have been found useful investigation perception of vowels, consonants, words and sentences.

One of the major limitations of electrophysiological measures is the lack of standardized procedures, especially in terms of stimuli used. At present these potentials are not elicited by the entire range of speech stimuli. Each potential is best evoked by a certain set of stimuli. There is still a need to investigate the use of different stimuli for eliciting these potentials. For example, it may be informative to examine the ACC in response to voicing and place-of-articulation changes in sustained consonants. It may be useful if transient brainstem responses can be recorded for stimuli other than stop consonants. Another reason for limited use of these potentials is that these measures are not time and cost effective. However, there is a scope for a lot of research in this domain.

Session: **ISP**

INSTRUMENTATION & SIGNAL PROCESSING

ISP01- HAND TALK ASSISTIVE TECHNOLOGY FOR DEAF AND DUMB

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The hand talk system is implemented for the physically disabled people. Hand Talk Assistive module system is embedded software controlled system for developing a novel speech synthesizer. In general, deaf people have difficulty in communicating with others who do not understand sign language. Even those who do speak aloud typically have a "deaf voice" of which they are self-conscious and that can make them reticent. The Hand Talk glove is a normal, cloth driving glove fitted with flex sensors. The sensors output a stream of data that varies with degree of bend made by the fingers. Flex sensors are sensors that change in resistance depending on the amount of bend on the sensor. They convert the change in bend to electrical resistance – the more the bend, the more the resistance value. The output from the sensor is converted to digital and processed by using microcontroller and then it responds in the voice using speaker. The components used are Microcontroller (LPC2148), Flex sensors, Voice IC(APR33) and developed using Kiel µvision, Embedded C. Used in medical applications such as wheel chair direction controlling and robotics. In future the glove can have 20 to 30 separate sensors, including pressure sensors and accelerometers to recognize full sign language.

Key words- Hand Talk, Sign language, Reticent, Flex sensor.

ISP02 - VISUAL TEXT AIDED SYSTEM FOR SIGN LANGUAGE

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In this paper, we propose a system which acts as an aid for persons with speech impairment. The proposed system recognizes hand movement (gestures) based on the sign language in real time. The sensors aligned in different directions senses the movement along the direction. The system on the whole identifies the hand movement based on bending degree. The algorithm selects the predefined text and simultaneously produces the speech output. The speech output is made available through an android mobile. The objective was to design a useful and fully functional real world project that assists the impaired people in better communication. In the proposed work 16 hand movements are recognized. The sensors are two accelerometers ADXL335 the processing is carried out by Atmega48 (micro controller). Through Blue tooth the microcontroller communicates with the android phone to display both the text as well as speech. The proposed work can further be enhanced to cover more gestures which definitely make the lives simpler for these people.

Key words- Speech impairment, Gesture, accelerometer, Communication, Text, Android Mobile

ISP03- DEVELOPMENT OF A PURE TONE SCREENER

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Pure tone screener proposed in this work is an audiometer used for mass screening of people with hearing loss. The objective of the pure tone screener is to review the evidence on screening and management of hearing loss of older adults in the primary care setting. This is essentially a sine wave generator capable of delivering desired frequency settings. The hardware is controlled to generate frequencies like 500 Hz, 1 kHz, 2 kHz and 4 kHz by varying frequency controller. A power amplifier finally drives the speaker. The audio intensities of the speaker output can be controlled to different intensities like 10 dB to 70 dB. At each frequency, sound level meter is used to

measure each subject with intensities at a distance of 6 inches. Calibration unit is required to overcome any variations with time and thus provide consistent intensity and frequency values. Finally 20 different audio signals of four different frequencies, each with 5 intensities are generated. This is given as test signal for the patients with hearing impairments to test their hearing ability. Typical case studies were conducted using the proposed PTS. Audio frequencies were synthesized using lab view. As an enhancement a portable device with self regulatory mechanism and a speech aided system could be developed.

Key words- Pure Tone Screener, Hearing Loss, Audio Frequencies, Amplifier

ISP04– APPLICATION OF AUTOMATIC SPEECH RECOGNITION IN COMMUNICATION SCIENCES AND DISORDERS

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Communication Sciences and Disorders encompass scientific understanding of communication in both typically-developing and communication-disordered population. During this process Speech language pathologists should incorporate new strategies and technologies for diagnosis and rehabilitation. One such Technology is Systematic Analysis of Language Transcripts (SALT) that manages the process of eliciting, transcribing, and analyzing language samples. However, the process seems to be time consuming and sophisticated. In the field of Speech Language Pathology automatic detection of the speech sample would enable the clinicians for quick decision making. Hence, a speaker independent automatic speech recognition tool was developed using Structured Query Language (SAL). The present study aimed to investigate the accuracy of speech recognition in a newly developed tool using SQL. A total of 30 subjects (15 males and 15 females) participated in the study within the age range of 18-30 years. All participants had normal communication skills. A standardized Rainbow passage was selected in the study. The participants were instructed to read the passage into the microphone connected to the computer with the designed tool in an acoustic treated room. The saved data was further analyzed for the automatic speech recognition score. The developed tool did serve the purpose of correct identification of utterances. It was concluded that the tool requires new noise reduction algorithms and further studies could be made by extension of vocabulary Consequent to above said refinement of the tool Speech Language Pathologists probably could use for automatic recognition of the speech sample for communication disorders.

Key words - Communication sciences, Automatic speech recognition, Structured Query language

ISP05 - ACOUSTIC EMISSION STUDIES ON WELD DEFECTED NUCLEAR GRADE MATERIALS

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This paper describes the acoustic emission investigation on Tungsten Inert Gas welding welded Stainless Steel (SS 316L) material with dimensions of 140*16*10 mm has been taken for these studies and fabricated with Tungsten Inert Gas welding (TIG) with implanted defects like porosity and pinhole in the welded area to get Acoustic Emission signatures by Acoustic Emission Linear Location Technique(AELLT) using AEWIN software procured from Physical Acoustic Corporation U.S.A. Constant load was applied on the material by using mechanical JIG to get the deformation in the welded region where the sensors are acquiring the test data for post analysis. The tests were conducted on two samples of the same defect weld material. The test is carried out and the acoustic emission signatures are recorded. X-ray Radiography testing is conducted on material to identify the defects to correlate with the acoustic emission signatures. The relative merits are discussed in the paper.

Key words- Acoustic Emission Linear Location Technique [AELLT]; Rradiography; Pinhole; Porosity; Jig.

Session : AH

AERO, HYDRO ACOUSTICS, BUILDING & ENVIRONMENTAL ACOUSTICS

AH01- FAN NOISE SOURCE CHARACTERIZATION USING NAH METHODS

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The characterization of the sound radiation from the product is a significant task to reduce the unwanted noise level during the design stage itself. The basic step when treating the noise problem is to locate the position of the source and source ranking. There are several methods (Direct & Indirect) to visualize the sound field and to find the noise source characteristic that is acoustic pressure, particle velocity, sound intensity and sound power. NAH (Near-field Acoustic Holography) is another alternative technique to know the detailed image of the acoustical field on the source surface for low frequency applications. By measuring the sound pressure at the closer distance around the actual source, it is possible to reconstruct all the acoustic quantities by using the inverse techniques. The purpose of this investigation is to use the NAH technique to know the distribution of fan noise source strength, radiation pattern by visualizing the sound radiation from the fan mounted in free space.

Key words- Fan Noise, Near Field Acoustic Holography

AH02- RIB OPTIMIZATION FOR MAXIMIZE THE STIFFNESS OF MARINE ENGINE FOUNDATION

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Vibration of a rotating machine like a diesel generator is a common problem. Diesel generator produces a considerable noise and vibration. So it is necessary to develop optimal design for diesel generator for vibration reduction. To reduce the vibrations it is necessary add stiffeners in redesigned foundation and it must be able to withstand the installation's weight and prevent deflection. In the present study topology rib optimization is carried out for optimal distribution of stiffening ribs for improves the stiffness. Initially, solid model of baseline model is generated using laser line probe coordinate measuring machine. Static analysis is carried out to find the strength and stiffness of existing engine foundation. Then topology rib optimization study is carried out for optimal distribution of stiffening ribs. From these results it is observed that considerable stiffness is improved with modified design compared to baseline model. In optimized model, there are four ribs are placed under the marine engine and three ribs are placed under the alternator.

Keywords- Engine foundation, diesel generator, static analysis, stiffens and rib optimization

AH03- EFFECT OF TEMPERATURE AND HUMIDITY ON SOUND ABSORPTION MEASUREMENTS IN A REVERBERATION CHAMBER

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Random incidence sound absorption measurements are carried out in Reverberation chamber as per standards like ASTM C 423 / ISO 354.ASTM C 423 requires that decay rates at 1000 Hz and above has to be corrected for air absorption as per ANSI S1.26. Air absorption is calculated as a function of temperature, relative humidity and barometric pressure. This study investigates effect of temperature, relative humidity and barometric pressure on sound absorption measurements. A very common method of determining the sound absorption of a material is ASTM C 423, which utilizes a qualified reverberation room with controlled temperature and humidity. It is well known that air absorption of sound has a very significant effect on absorption measurements, particularly at higher frequencies of interest. For the purposes of ASTM C 423, ANSI S1.2 is used to correct measurements for the effects of changes in room temperature, relative humidity and barometric pressure. This paper concentrates on the contribution of changes in temperature and humidity and neglects the contribution of changes in barometric pressure for two reasons – first, barometric pressure fluctuation has a small effect on air absorption as compared with temperature and relative humidity, and second, it cannot be readily controlled as temperature and relative humidity can

be. At the end, the paper presents effect of temperature and humidity on measured sound absorption coefficient in a reverberation chamber.

AH04 - STUDIES ON THE ACOUSTICAL DESIGN AND PERFORMANCE OF AN AUDITORIA

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Large halls are extremely complicated physical systems and to understand them is a substantial challenge. In modern acoustic practice, the intelligibility of speech is evaluated through a number of objective indicators that express the subjective response of the listener to the speaker at the top is the reverberation time (T). The other indicators include Definition (D50), Speech clarity (C5), Sound pressure level (SPL), Sound strength (G), Speech transmission Index (STI), Rapid Speech Transmission Index (RASTI), Background noise level (BGNL) and others. We can readily devise a variety of complex physical parameters to describe such spaces.

Architectural acoustics in general has objectives that comprise of providing optimal listening conditions with reasonable clarity and free from acoustical defects such as echoes& excessive reverberation. Recently acoustical design of an auditorium is accomplished using computational modeling techniques such as ODEON, CATT and EASE. In this work, an attempt has been made to evaluate large sized auditoria using these techniques. During this prediction procedure, a three dimensional CAD model is generated for use with the acoustical modeling software. An impulse response of the space is simulated within the model for specific receiver positions, sound source, characteristic and architectural parameters of the space. Acoustical objective measures such as T30 and C80 can be calculated from the impulse response. The most effective use of computer modeling is to predict the response of the auditoria of different shapes and geometries. In this study, the parameters such as early decay time, clarity, definition and lateral efficiency have been computed and compared with some of the existing acoustically superior auditoria.

AH05 - ACOUSTICAL CHARACTERIZATION OF LIVE MUSIC AND SINGING IN NOSSA SENHORA DO PILAR CHURCH, GOA

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This case study was conducted at the church of NossaSenhora do Pilar, Goa. This study is a part of a series of tests to gauge the difference in the acoustical climate in this 400 year old church from the pre-restoration phase to the post-restoration phase. The worship space was acoustical characterized using objective acoustical parameters (*RASTI, RT*, *D50, C80, TS,* and *LAeq*) and subjective acoustical impressions of listeners for live performances of sacred music and sacred singing,.The impact of the church, as a performance space, on listeners was deduced from the recorded subjective acoustical impressions in terms of induced reverential awe, sacred intelligibility and sacred liturgical silence using derived acoustical indices, namely, Acoustical Comfort Impression Index (ACII), Subjective Sacred Factor (SSaF), Subjective Intelligibility Factor (SInF) and Subjective Silence Factor (SSiF). Solo performances on stringed and blowing instruments were compared with solo voice recitals. A choral group with and without accompaniment was also tested. Two different performance locations in the worship space were tested for ensemble music and for choir singing. The listeners, mainly post-graduate college students, were deliberately chosen from amongst non-church goers and were trained to make their subjective acoustical preferences according to the acoustical traits enlisted in the score sheets. The performers were regular church choir members, accustomed to playing sacred music and singing in churches. Amongst the significant results, the choir loft source location registered a 89% better L_{Aeq} value and 80% better RASTI value than the nave floor source location. Amongst the subjective acoustical results, *ACII* ($p = 0.15$), *SSaF* ($p = 0.06$) and *SInF* ($p = 0.18$) for sacred singing by the choir with an accompanying ensemble at the choir loft location showed significantly better results than those from the nave floor location. The values of the objective acoustical parameters obtained in this survey were compared with those obtained earlier, so as to gauge the

Session: **VN**

VIBRO ACOUSTICS & NOISE

VN01- OPTIMIZATION OF ENERGY HARVESTING FROM NONLINEAR DYNAMIC VIBRATION ABSORBERS

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This paper considers analyzing and optimizing the energy harvesting mechanism of a nonlinear dynamic vibration absorber. A two degree of freedom vibrating system is considered with a Duffing's oscillator used as a vibration absorber appended to a linear primary system excited by a harmonic force. Electro-Mechanically coupled bimorph piezoelectric transduction layers are attached to the nonlinear absorber and connected to a resistive load to act as the energy harvesting mechanism. The equations of motion representing the two degree of freedom nonlinear system including the electro-mechanical coupling effects and the voltage corresponding to the electrical circuit are solved using the harmonic balance method. The solutions agree with the numerically integrated solutions. It is observed that in spite of the nonlinearities in the system and the electro-mechanical coupling the frequency response of the primary system passes through two fixed points approximately like in the case of the linear damped dynamic vibration absorber analyzed by Den Hartog. The two fixed point theory is used to obtain optimum parameters of the system like damping and tuning ratios and electro-mechanical coupling coefficients for simultaneous vibration reduction and maximum energy harvested. The two objectives of minimum vibration and maximum energy harvesting demand conflicting requirements on the system parameters. The multi-objective optimization problem is solved by an adaptive weighted means technique and 2-D Pareto optimal fronts are constructed to identify the feasible solution set and obtain optimum system parameters. The optimized energy harvesting -vibration absorber system is found to function efficiently on both metrics compared to the un-optimized systems.

VN02 - ACOUSTICAL PERFORMANCE OF RUBBER CRUMB MATERIAL

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The improvement on the human quality of life and the continuous growth in population in developing and developed societies has resulted into several environmental and financial problems. One of the problems is related with ground tyre waste created by transport industry. The amount of waste tyres is increasing due to the highest demand for tyres and their short lifetime. It is therefore necessary to improve or to develop certain process or applications for recycling waste tyres. In order to contribute to the solution of the environmental problem created by the tire waste ways, a possibility of using tyre rubber crumb as an acoustical material was studied. The experimental sound absorption coefficient and sound transmission loss of rubber crumb material was measured in a two-microphone impedance tube and in a reverberation chamber. Intrinsic parameters of rubber crumb material were also measured and used for simulation of absorption coefficient and sound transmission loss. The paper presents use of rubber crumb material as an alternative to current acoustic materials. The paper also compares the experimental results with theoretical predictions, which can be used in design of multi layers in later stage.

Key words- Sound absorber, Recycler rubber, Acoustical properties, Impedance tube, Simulation

VN03 - AN ANALYSIS OF WEAKLY NONLINEAR ACOUSTIC WAVE PROPAGATION IN FLUID-FILLED ISOTROPIC AND ORTHOTROPIC CYLINDRICAL SHELLS WITH AND WITHOUT PERIODIC SUPPORTS

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The effect of nonlinear acoustic wave propagation of non-planar modes with small but finite amplitudes in infinite isotropic and orthotropic thin circular cylindrical shells is studied. The fluid is assumed to be ideal, inviscid and with no mean flow. The approximate solutions for the acoustic velocity potential are found using the method of multiple scales in space and time. The dynamic equations of the circular cylindrical shell are derived using Donnell's nonlinear theory for thin cylindrical shells. Firstly, only traveling waves that propagate over a long distance are considered and two types of behavior are observed for the coupled waves: a) at certain frequencies, particular modes of the coupled system are in resonance with the corresponding modes of higher harmonics. In the neighborhood of these resonance frequencies, two wave resonances (primary mode and second harmonic mode) are observed which give rise to parametric amplification at these frequencies. This phenomenon occurs at three distinct frequencies for each mode, b) away from such resonance frequencies, the Nonlinear Schrodinger Equation (NLS) governs the amplitude modulation of modes. Also, an infinite shell with periodic supports is considered and stationary coupled waves are studied at multiple scales of time and the shift in the resonance frequencies due to nonlinearity is discussed.

VN04 - SENSITIVITY ANALYSIS FOR CLF OF LINE CONNECTED AND POINT CONNECTED SYSTEMS**.**

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Sensitivity analysis is performed to understand the sensitivity of a model to changes in the design parameters of the model. In a structural optimization problem, objective function could be weight, stresses, loads, displacements, frequency, cost etc. or a combination of these. Objective function is decided based on the objective of design. For optimizing the vibration levels of system, total energy or damping of the subsystem can be the objective function. Sound pressure level in the subsystem will be the objective function for the reduction of noise from any system. Finite element method (FEM) and boundary element method (BEM) are primarily used for solving low frequency vibro-acoustic sensitivity and optimization problems. Noise and vibration response is very sensitive to changes in model parameters in the high frequency region. Statistical energy analysis (SEA) is widely used for solving such high frequency problems. Design sensitivity analysis in the SEA framework is still not fully developed. Here, sensitivity analysis is performed to study the effect of variation of geometrical parameters and material properties on the coupling loss factor of the connected system forming various joint connections. The first and second order sensitivity analysis is performed using the derived analytical expressions for the coupling loss factor in SEA framework. Both direct method and finite difference method is used to perform the first and second order sensitivity analysis. The results comparison is done with these two methods. It is found that for selected configuration of joints, bolt joint can be used in frequency range of 4000 Hz to 10000 Hz and weld joint can be used in frequency range of 6000 Hz to 10000 Hz.

VN05 - OPTIMIZATION OF SHEET METAL PANEL GEOMETRIC FEATURES FOR EFFECTIVE NOISE CONTROL

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Sheet metal panels are used to protect machine components from the external environment. Vibration produced due to moving and rotating parts of the machine is transferred to these panels, leading to noise generation. Most of these panels have special features to stiffen them. In this paper the vibro-acoustics of a sheet metal panel with such surface features is investigated using numerical

methods. Six different features with four different excitation patterns are considered for comparison. The surface feature geometry is optimized for minimum vibration amplitude so as to achieve reduction in sound power radiated. The best feature geometry for sound reduction in the range of 100-200 Hz has been identified and this feature is shown to reduce the overall noise level by about 4-5 dB.

VN06 - 3-D FEM AS WELL AS 1-D ANALYSIS OF A THREE-PASS DOUBLE-REVERSAL MUFFLER

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The exhaust noise of an automotive engine is known to have peaks at the engine firing frequency and its first few multiples. Therefore, an efficient exhaust muffler must be designed for wide-band Transmission Loss, TL (rather, Insertion Loss, IL) with particular attention to the lower frequency range (of the order of firing frequency). Another important design requirement is low or minimal back pressure. Both these requirements can be met quite well by means of hybrid three-pass double-reversal muffler configurations because of interaction of waves in the three pass tubes with those in the annulus as well as the end chambers. This paper deals with analysis of such a configuration from the acoustical as well as back pressure point of view.

The hybrid three-pass double-reversal muffler consists of three perforated pipes arranged along the major axis of an elliptical shell lined or filled on the inside with absorptive material, with two short end-inlet/outlet chambers at the two ends. Making use of matrizant approach and appropriate combination of the three chambers, the overall transfer matrix of the muffler is evaluated and thence TL as well as IL of the muffler are predicted. In this configuration, a flow-resistance network approach has been presented that makes use of the electrical circuit analogy in order to evaluate the mean flow distribution, which is then extended to evaluate the overall back pressure of the muffler.

The results have been compared with the 3-D FEM simulations and good agreement has been achieved between the two methods. The results indicate that hybrid three-pass double-reversal mufflers are good at low frequencies as well as high frequencies. Finally 1-D analysis of the hybrid three-pass double-reversal mufflers (lined or filled with acoustically absorptive material in the middle chamber) is presented along with some parametric studies with useful guidelines for muffler designers.

VN07 - PREDICTION OF NON-CAVITATING NOISE OF AN OPTIMIZED MARINE PROPELLER

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Sound generated by a propeller is critical in underwater detection, and it is often related to the survivability of the vessels especially for military purposes. Noise reduction and control is an important problem in the performance of underwater acoustic systems. This paper presents a numerical study of unsteady non-cavitating marine propeller with 4, 6 and 8 blades using eddy viscosity model of large eddy simulation (LES) available in computational fluid dynamics fluent software. Propeller behaviour is investigated for its hydrodynamic parameters and then computational acoustic analysis is carried out using Ffowcs Williams–Hawkings (FW-H) formulation. Noise is predicted using time-domain acoustic analogy and finite volume method. Sound pressure levels are predicted at different receiver positions. The receiver position is 1m in downstream of propeller aligned to the propeller shaft. From this numerical study on these three propellers it is found that the propeller with 6 blades generates least noise compared other two propellers.

Keywords- Marine Propeller, Non-cavitating Noise, turbulent flow, Computational Acoustic Analysis (CAA), large eddy simulation, Ffowcs Willams-Hawkings formulation (FW-H).

VN08- SELF RADIATION EFFICIENCY OF VIBRATION MODES OF A HEATED ISOTROPIC PLATE

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Self-radiation efficiency associated with the free vibration mode shapes of an isotropic plate clamped along its edges exposed to a uniform temperature rise above ambient temperature has been investigated using combined finite element method and Rayleigh integral. Initially critical buckling temperature and free vibration mode shapes at different elevated temperatures in fraction of critical buckling temperature are obtained using finite element method followed by radiation efficiency of different vibration modes using Rayleigh integral. Influence of different modes including corner and edge modes on self-radiation efficiency at different temperature has been investigated. It is observed that free vibration mode shapes associated with lower frequencies changes significantly with increase in temperature above ambient temperature. It is found that self-radiation efficiency of a particular mode increases with temperature only when there is a significant change in free vibration mode shapes with increase in temperatureand the temperature rise above ambient temperature is near the critical buckling temperature.

VN09 - FLOW-ACOUSTIC ANALYSIS OF THE THREE-CHAMBER SAME-END INLET-OUTLET MUFFLER WITH PERFORATED BAFFLES

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The investigation reported here deals with three-chamber same-end inlet-outlet muffler with perforated baffles, followed by parametric studies in order to evolve design guidelines. One-dimensional transfer matrix based muffler program (TMMP) and three-dimensional finite element method (FEM) have been used for the prediction of the TL of the muffler. Presence of perforated baffles necessitates use of the Integrated Transfer Matrix (ITM) approach for the one-dimensional analysis because the sound fields in the adjacent chambers would be multiply coupled with each other, and for the 3D FEM analysis LMS Virtual Lab software has been used. The mean flow distribution in each of these configurations has been evaluated by means of a lumped flow resistance network. The resulting values of the grazing flow and bias flow have been used to calculate the perforates' acoustic impedance. TL calculated with the help of the 1D analysis shows good agreement with the simulated results from the 3D FEA.

Parametric studies on both the three-chamber perforated-baffle configurations have revealed that the primary features accounting for their wide-band TL characteristics are: i) The wave-cancellation effect of the multiply-connected chambers made possible by the low-porosity baffles; ii) Absorptive effect of the acoustically filled chamber in the hybrid configurations.

Key words - Integrated Transfer Matrix Approach; Multiply-Connected Muffler; Lumped Flow Resistance Network; Acoustic Impedance of Perforates.

Session: **PA-UW-UL**

PHYSICAL ACOUSTICS, UNDERWATER ACOUSTICS & ULTRASONICS

PA-UW-UL01- ACOUSTICAL LIGHTWEIGHT PARTITION DESIGN FOR RESIDENTIAL AND COMMERCIAL BUILDINGS IN INDIA

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Today's residential and commercial property owners are concerned about the comfort and safety of the interior environment. Unwanted sound, or noise, is one factor that can influence these conditions. Lightweight partition constructions are used extensively in India to control airborne and structure-borne sound transmission through walls and floor-ceiling assemblies. However, the benefits of high performance acoustical systems can be lost because of improper installation or poor construction details. This paper will describe the commonly specified, standardized test methods and sound control practices, as per ISO 140 (Part III) used to determine the acoustical performance of lightweight partition constructions. Sound flanking paths, sound leaks and structural short circuits that decrease the effectiveness of sound insulating systems will be identified with solutions presented.

PA-UW-UL02- ULTRASONIC STUDY OF MOLECULAR INTERACTION IN BINARY MIXTURE OF DI-N -BUTYL PHTHALATE (DBP) WITH POLAR LIQUIDS AT DIFFERENT FREQUENCIES

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Ultrasonic study of molecular interactions in a binary mixture of Di-n-butyl phthalate (DBP) with polar liquids is carried out at different frequencies (1MHz, 3MHz, 5MHz, 7MHz) and at constant temperature. The experimental measured values of density (ρ) and ultrasonic velocity© of the binary mixture are used to calculate the different acoustic parameters like isentropic compressibility (β) intermolecular free length (L_f), acoustic impedance (z), relative association (R_A), molar sound velocity ($R_{m),}$ interaction parameter (χ). Excess value of the above parameters like excess isentropic compressibility (β^E) excess intermolecular free length (L_f^E), excess impedance (Z^E) and excess molar volume (V^E).excess ultrasonic velocity (U^E) are also calculated. These acoustic parameters and their excess values are used to access and explain the nature and strength of molecular interaction of DBP with polar liquids.

Key words- Binary mixture, ultrasonic velocity, isentropic compressibility, intermolecular free length, acoustic impedance, relative association, molar sound velocity, interaction parameter.

PA-UW-UL03 - VISCO METRIC, ULTRASONIC AND THERMODYNAMIC STUDIES IN APROTIC-APROTIC BINARY MIXTURE

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Ultrasonic velocity (U), density (ρ) and coefficient of viscosity (η) ofaprotic-aprotic binary mixture of dimethyl acetamide (DAMC) and isobutyl methyl ketone at different frequencies ($2MH_Z$, 4MHz $6MH_{Z,}$ $8MH_Z$) have been measured at temperature 308K. Adiabatic compressibility (K_s), intermolecular free length (L_f), free volume (V_f), internal pressure (π_i) and their respective excess values have been computed for entire range of mole fraction and are interpreted to explain molecular interaction occurring in the liquid mixture. Relaxation time (τ), excess enthalpy (H^E) and absorption coefficient (α/f^2) have been calculated and discussed. The negative excess values of coefficient of viscosity (η^E), velocity U^E and positive excess values of intermolecular free length (L_f^E) for the whole composition range of DMAC indicate the presence of dispersion forces in binary liquid mixture for all frequencies. The increase in relaxation time (τ) and absorption coefficient (α/f^2) with the increase in frequency for a fixed concentration of DMAC indicate the reduction

in molecular interaction in the binary liquid mixture

Key words-Ultrasonic velocity, free volume, internal pressure, relaxation time, excess enthalpy and absorption coefficient

PA-UW-UL04 - MOLECULAR INTERACTION STUDY IN DEWAXING OF CRUDE PETROLEUM OIL BY ULTRASONIC TECHNIQUE

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The dewaxing process is an important step in oil refinery industry. The process of dewaxing can be more accelerated by a systematic study of molecular interactions in liquid mixture used for dewaxing process. The ultrasonic velocity and density measurement has been undertaken by covering a wide range of mixing temperature (30°C to 50°C) in presence of high intense ultrasonic beam at 5MHz in binary mixture of MEK with toluene and benzene. The dewaxing process is discussed in terms of molecular interaction by calculating acoustic parameters and their deviated values. The variation of different acoustic parameter with temperature and concentration shows removal of most of the wax in a sample of crude oil of 75% MEK at mixing temperature of 50°c and solvent to oil ratio of 20:1.

Key words- Crude oil, dewaxing, acoustic parameter, molecular interaction.

PA-UW-UL05 - ULTRASONIC STUDY OF SURFACE TREATMENT OF NATURAL FIBER WITH MALEIC ACID BLENDED ALCOHOLS

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The structural integrity in composite materials can be well understood from surface morphology of the natural fiber. The surface modification of fiber aimed at improving the adhesion between the fiber surface and polymer matrix. The chemical treatment on surface of fiber not only modify the fiber surface but also increase the fiber strength, reduced the water absorption and enhances the mechanical performances of the composites. Seeking to improve the adherence fiber/matrix, a treatment in sisal was performed with solution of maleic acid blended with alcohols. These studies done by study of molecular interaction in chemical mixtures used for surface bleaching. The measurement of ultrasonic velocity and density are used to calculate different acoustic parameter. The ultrasonic sound velocity measured for different temperature varies from 30°c, 40°c, and 50°c at frequency 5MHz.

Key words- Acoustic parameter, composite material, molecular interaction, Sisal, surface modification

PA-UW-UL06 - ACOUSTIC STUDIES ON POLAR EXTRANTS WITH NON POLAR DILUENTS AT DIFFERENT FREQUENCIES

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Ultrasonic velocity and density measurement have been undertaken for polar extrants like tributyle phosphate (TBP) with non-polar diluents like kerosene over the entire mole fraction range of TBP at 303.15k for different frequencies. The thermo-acoustic parameters and their excess functions have been computed from the experimental data and used to shed light upon the molecular interactions present in the polar-non polar binary systems. Ultrasonic velocity in pure TBP is less than that of kerosene and shows a significant bump at 0.3 mole fraction of TBP. The variation of other calculated parameters are agrees with such variation of velocity and execute their variation at same 0.3 mole fraction of TBP. The ultrasonic velocity and other calculated parameters show a non linear variation with excess concentration and frequency. This non linear behavior indicates the existence of molecular interactions.

Key words- Solvent extraction, TBP, molecular interactions, thermo-acoustic parameter.

PA-UW-U07 - ULTRASONIC AND SPECTROSCOPIC STUDIES ON TERNARY MIXTURE OF CYCLOHEXANONE + 2-ETHOXY ETHANOL + ETHYLACETATE

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Knowledge of thermodynamic and acoustic properties is of great significance in studying physico-chemical behavior and various interactions of liquid mixtures. Experimental densities, viscosities and sound velocities of the ternary mixture Cyclohexanone + 2-Ethoxy Ethanol + Ethyl Acetate have been measured at 303.15K,308.15K and 313.15K for the entire range of mole fraction. From these data, excess volume (V^E) and thermodynamic and their excess parameters has been calculated. Experimental and computed results are used to study the type and nature of inter and intra molecular interactions between the mixing components. Even though these types of studies exist in the literature there is no confirmation for the observed excess properties through other non-ultrasonic techniques. For the confirmation of the excess properties FTIR spectra have been taken in the regions and also for the participating pure liquid components. FTIR spectra were taken for the liquid mixtures in a FTIR spectrum photometer by using the KBr pellet method.

PA-UW-UL08 - AN ANALYSIS OF UV-VIS SPECTRA AND THERMOCHEMICAL PARAMETERS OF AMIDES

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Ultrasonic study is the subject of extensive research and finds its usefulness in the fields of biology, engineering, medicine, polymer chemistry etc. Spectroscopy study involves the absorption, emission or scattering of electromagnetic radiation by atoms or molecules to study qualitatively/quantitatively a physical parameter. Ultrasonic velocity of sound waves in a medium is fundamentally related to the binding forces between the molecules. The attraction and repulsion between the molecules of components involved show considerable effect upon the physical and chemical properties of a solution such as density, viscosity and ultrasonic velocity. Drug-macromolecular interactions are an important phenomenon in physiological media, such as blood-membranes, intra and extracellular fluids. The drug–solvent molecular interaction plays an important role in the understanding of drug action. Viscometric properties provide valuable results for solute–solvent interactions in the solution phase. Such results can be helpful in predicting the absorption of drugs and transport of drugs across the biological membranes. Sulfa drugs were the first antimicrobial drugs, and paved the way for the antibiotic revolution in medicine. Sulphanilamide is the parent compound which is important in urinary tract infections and meningococcal meningitis profilaxes. Another sample Benzene sulphonamide is used in the treatment of gastrointestinal, duodenayl ulcer, neurological disorder. Sulphadiazine is an essential for folic acid synthesis used in the treatment of rheumatic fever and meningococcal meningitis. All the three samples are analyzed in non aqueous medium. UV –VIS Spectroscopic study have been used to identify the various functional groups. In the present work, non-aqueous solutions of drug amides have been prepared with different concentrations and the experiments were carried out from a low temperature of 5'c to a high temperature of 55'c. The various interactions .occurring in the solutions are interpreted in terms of ion-ion and ion-solvent interactions.

Keywords- UV-VIS Spectra, Thermochemical parameters, ion- ion interactions, ion-solvent interactions

PA-UW-UL09- IMPACT OF SINTERING TEMPERATURE ON $La_{0.1}Ca_{0.9}MnO_3$ PEROVSKITE MANGANITE EMPLOYING ULTRASONIC STUDIES

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$La_{0.1}Ca_{0.9}MnO_3$ Perovskite manganite samples was prepared using solid state reaction technique at three different sintering temperatures such as 1073, 1273 and 1473 K. The crystalline nature of the samples was confirmed by XRD patterns. The samples were found to

have orthorhombic structure with pnma space group. The SEM images of the samples were used to determine the particles size. In-situ measurement of ultrasonic parameters such as longitudinal and shear velocity were carried out employing through transmission method operated at the fundamental frequency of 5 MHz The ultrasonic parameters have shown an interesting anomaly at the phase transition. Further, it has been observed that the transition temperature and the particle size of the samples were influenced by the sintering temperature.

Key words- Perovskite, Sintering, Ultrasonic velocity, Transition temperature.

PA-UW-UL10 - MECHANICAL PROPERTIES OF Gd DOPED $LaCrO_3$ PEROVSKITE MANGANITE MATERIALS

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Non-destructive ultrasonic measurement is a versatile tool to study the mechanical properties of materials. In the present study, gadolinium doped $LaCrO_3$ isovalent samples were prepared using conventional solid state reaction method with the doping concentration of 0, 2.5 and 5 wt.%. The XRD diffraction spectra of the samples have confirmed the crystalline nature. The samples have orthorhombic structure and belong to pnma space group. In-situ measurement of ultrasonic parameters were carried out using through transmission method with the fundamental frequency of 5 MHz on the isovalent samples over a wide range of temperature 400 to 600 K. The mechanical properties such as longitudinal, shear, bulk and Young's modulus of the isovalent samples were obtained from the measured ultrasonic velocities. It is significant that the temperature dependence of mechanical parameters show an anomalous behaviour in transition temperature. It was used to explore the behaviour of phase transition temperature. It was observed that the increase in doping concentration leads to a decrease in phase transition temperature.

Key words- Perovskites, Ultrasonic measurements, Elastic moduli, Phase transition.

PA-UW-UL11- PHASE TRANSITIONS OF BULK AND NANOCRYSTALLINE $La_{1-x}Pb_xMnO_3$ PEROVSKITEMANGANITE MATERIALS EMPLOYING ULTRASONIC VELOCITY MEASUREMENTS

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$La_{1-x}Pb_xMnO_3$perovskite manganite samples for different Pb contents (x=0.30, 0.40 and 0.50) were synthesized in bulk and nano structure form using solid-state reaction and sonochemical methods, respectively. The different characterization studies like X-ray diffraction, scanning electron microscope and transmission election microscope were carried out to characterize the prepared bulk and nanosamples. The XRD characterization studies confirmed that the prepared perovskite manganite samples were crystalline in nature. The SEM and TEM studies revealed that the particle sizes of bulk perovskite samples is in the range of 0.75–85 μm, whereas it ranges from 50 to 90 nm in the case of nanoperovskite samples. Further, it has been confirmed that there is an increase in particle size with an increase in Pb content both in bulk and nanoperovskite samples. In addition, ultrasonic velocities of bulk and nanosamples were measured using the *in-situ*ultrasonic through transmission method.The temperature-dependent first differential of ultrasonic velocities showed an interesting anomaly in perovskite samples. The observed strong softening and hardening in sound velocities were related to ferromagnetic to paramagnetic phase transition temperature (T_C). The observed broad ferromagnetic (FM) –paramagnetic (PM) transition in nanoperovskites confirms the absence of sharp transition, which is attributed to the coexistence of orbitally, ordered and disordered phases.

Key words- A. Magnetic materials, C. Ultrasonic measurements, D. Phase transitions, D. Elastic properties

PA-UW-UL12- SYNTHESIS AND ONLINE ULTRASONIC CHARACTERISATION OF $CATI_{1-x}FE_xO_3$COMPLEX NANO PEROVSKITE

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The preparation of complex nano material named $CaTi_{1-x}Fe_xO_3$(CTFO) was synthesized by novel sol-gel route with different sintering approach. Chemical treatment of 1 M% Fe^{3+} substitution in Ti location caused considerably increase in ionic and electronic conductivity. The perovskite electroceramics were sintered at 773, 1173 and 1523 K using high temperature furnce. XRD confirms the phase structure of CTFO as suggests which are orthorhombic in nature. In this work we were observed anamolous behavior of CTFO composition at room temperature to 1200 K. The temperature dependance of ultrasonic velocities, attenuation and relative elastic moduli were determined in all sintered ceramic samples. The observed results of each sample were subjected to temperature (300 – 1200 K) and inhibition of ulrasonic waves are used in longitudinal and shear wave modes. Thus confirmed the phase transition occurred above 1023 K towards paraelectric state to ferroelectric material. The iron doped calcium titanate nanocrystalline powders were generally characterized by FTIR, DLS, XRF, XRD, TG/DTA, SEM and online ultrasonic measurements.

Keywords: Electroceramic material, Ultrasonic measurements, Elastic properties, Phase transition, iron doped $CaTiO_3$, CTFO

PA-UW-UL13- CHARACTERIZATION OF BULK AND NANO $La_{1-x}NA_xMNO_3$ PEROVSKITES EMPLOYING IN-SITU ULTRASONIC MEASUREMENTS

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The bulk and nanostructured manganites were synthesized with different compositions, namely x = 0.16, 0.18, and 0.20. X-ray diffraction, Fourier transform infrared spectroscopy, scanning electron microscopy, and transmission electron microscopy were used to characterize both bulk and nanostructured perovskite samples. The bulk and nanostructured $La_{1x}Na_xMnO_3$ have rhombohedralstructures. On-line ultrasonic velocity and attenuation measurements were carried out using an indigenously designed ultrasonic set up in the temperature range from 300 to 400 K during the aging of the prepared manganite samples to explore the structural/phase transitions. The variation in measured ultrasonic velocities and attenuation, and derived elastic moduli, shows an irregular behavior as a function of temperature in both bulk and nanostructured perovskite samples. The observed anomalous behavior was correlated with occurrence of ferromagnetic–paramagnetic transition temperature (T_C) in both bulk and nanostructured perovskite samples. In addition, the shift in T_C and the magnitude and width of the observed anomalies with increase in composition of x are used to study the behavior of T_C and change of nanostructured to bulk perovskites.

Key words: *Magnetic material, Ultrasonic measurements, Elastic properties, Phase transition*

PA-UW-UL14- ROLE OF ENVIRONMENT ON CROSS-CHANNEL ACOUSTIC PROPAGATION IN THE KOCHI ESTUARY - A CASE STUDY

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Recently the focus of ASW oceanography changed from Open Oceans to coastal regions due to the terrorist attacking incidents that happened. Coastal surveillance programs mainly based on RADAR for operations in the air and SONAR for underwater have been initiated. There is a need to fine tuning SONAR sensor technologies, which have been performing fairly well in the open ocean, to work in shallow coastal water. The performance modeling of the systems developed for shallow waters need the knowledge of environment. The present study made use of the data viz., Temperature and Salinity profiles collected across the channel at three location in the Kochi estuary on temporal scales ranging from semi-diurnal to seasonal, to

document the role of environment on the acoustic propagation. In the estuary sound speed structure is mainly dependent on the salinity structure with positive gradients. Sound speed profiles across the channel representing various temporal regimes are utilized to run the range dependent acoustic model.

Keyword: Estuary, sonar, temporal variability.

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PA-UW-UL15- ULTRASONIC VELOCITY, VISCOSITY AND DENSITY OF ALCOHOL + TRIETHYLAMINE +ACETIC ACID MIXTURE AT DIFFERENT TEMPERATURE

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The ultrasonic studies have always played an important role in understanding the nature of inter molecular interaction in liquid mixtures. It is the useful technique for understanding its physiochemical properties and is extensively used to study of molecular interactions in pure liquids, liquid mixtures. It is basically related to bonding forces between atoms and molecules. The outcomes of these results thus obtained are discussed in terms of molecular association. By measuring density, viscosity and velocity other important thermodynamic parameters can be calculated, which are further useful in exploration of nature of the interactions on molecular level. The nature shown by these parameters indicates the intermolecular interaction existing between the components. The ultrasonic velocity (v), density (ρ) and viscosity (η) measurements of ternary liquid mixtures of *Alcohol +Triethylamine +Acetic Acid* are done at three different temperatures 303k, 308k, 313k at 3MHz using ultrasonic interferometer by Mittal Enterprises New Delhi. The densities (ρ) of the system were measured on electronic balance with pre calibrated density bottle. The constant temperature is maintained at specific temperature using constant temperature bath unit and the viscosity is measured with Ostwald viscometer. The measurement of viscosity in ternary liquid mixture gives some reliable information in the study of intermolecular interaction. The measured ultrasonic parameters are graphically plotted against mole fraction. The experimental results are used to interpret the molecular interactions in ternary liquid mixture. The non linearity and wave like nature indicates presence of intermolecular interaction between the components of mixture.

PA-UW-UL16- MID-TO-HIGH FREQUENCY (6-12 KHZ) ACOUSTIC BOTTOM BACK SCATTERING FROM LITTORAL SEABEDS

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When a sound signal is transmitted underwater, it is scattered by the rough sea surface, sediment interface and volume and in homogeneities in the water column. The component of incident energy returned by the sea bottom back to the source is referred to as bottom back scattering which leads to reverberation in active sonar. Sea bottom scattering limits the performance of many sonar systems. Mid-to-high frequency (6-10 kHz) acoustic bottom back scattering measurements made at a shallow water location in the Arabian Sea off the west coast of India are presented. The data collected here represents an azimuthally averaged scattering strength as a function of grazing angle. Results are compared with bottom scattering models to differentiate the contributions of interface roughness and sediment volume scattering. Data model comparison suggests that back scattering strength is frequency dependent and increases with increase in frequency. Data shows that there is only a weak dependence of back scattering strengths on grazing angle from 15-25degrees. However, in the grazing angle range of 25-50degrees, the scattering strengths increase by about 5 dB. Data analysis results combined with interpretive modeling analysis show that the volume scattering is dominant over interface roughness scattering and the sediment volume scattering parameter may increase with increase in depth.

Key words– Reverberation, Bottom back scattering, Sediment Volume Scattering.

PA-UW-UL17 - STUDY OF SOLVATION AND SONOCHEMICAL EFFECT ON PANI NON-AQUEOUS SOLUTION USING ULTRASONIC VELOCITY

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Ultrasonic characterization of materials is playing an important role for the study of structural, intermolecular interaction and their binding nature. Measurement of ultrasonic velocity comes up as a pivotal probe in the quantitative assessment of cohesive energy of a liquid system. For the past few decades nanomaterials of polymer particularly polyaniline have attracted significant interest due to its excellent thermal and environmental stability. In the present work, ultrasonic velocity and density are determined for polymer solutions. Solvation number is an interesting aspect posed by the conducting polymer family. It depends on the number of moles of the solute and the solvent molecules present in the solution. Effect of solvation is studied by finding the solvation number at various temperatures and at different concentrations. Sonication has effects on both physical and chemical properties of the solution. The isolated dry products of the polyaniline derivatives after sonication are further characterized by SEM analysis which confirms the existence of nanoparticles.

Key words- Ultrasonics, Sonication, Solvation number and nanoparticles.

PA-UW-UL18 - COMPATIBILITY AND ACTIVATION ENERGY STUDIES OF BLENDS OF PMMA 350000 IN 1, 4 DIOXANE BY ULTRASONIC AND RELATED TECHNIQUES

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The scientific and commercial progress in the area of polymer blends during the past two decades has been tremendous and was driven by the realization that new molecules are not always required to meet the needs of new materials and that blending can usually be implemented to meet the needs of new materials more rapidly and economically than the development of new chemistry. Since the beginning of the plastic industry it has been recognized that blending yields materials with properties superior to the feature of the individual components. There has been progress in the understanding of the behaviour of polymer blends especially the thermodynamics and rheology. New blends are constantly being developed characterized and blends with different desirable features are now available. Blending technology is also used in the field of plastic recycling. In the present study, activation energy of Poly(methyl methacrylate) (molar mass 350000) in 1,4 Dioxane is determined using viscometry technique. The miscibility nature of PMMA 350000 with PS 35000 is analyzed for various compositions using ultrasonic velocity, density, viscosity and refractive index techniques at 303 K and reported in detail.

Key words- Activation energy, Blend, Miscibility, Refractive index, Ultrasonic velocity

PA-UW-UL19 - A STUDY OF ACOUSTIC AND SOLVATION PROPERTIES OF GLYCYL SALTS IN NON AQUEOUS MEDIUM

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Ultrasonic technique is a reliable procedure that has been successfully employed in understanding the nature of molecular interactions in liquids/solutions. Ultrasonic velocity measurements are highly sensitive to molecular interactions and used to provide qualitative information about the physical nature and strength of the molecular interactions. Probing biomolecules by ultrasonic technique is novel and powerful tool for characterizing their physicochemical properties. Amino acids and peptides are the fundamental and structural units of proteins. Therefore systematic study of peptides can provide valuable information about the solubility, folding/unfolding processes, denaturation of proteins etc., in solutions.

The peptide, Glycyl-L- Valine acts as a nutritional supplement and pharmaceutical intermediate. In the present study, density, viscosity and ultrasonic velocity of non aqueous solutions of glycyl valine are measured from very low temperature to very high temperature for various concentrations. By measuring the fundamental parameters, the adiabatic compressibility. Specific acoustic impedance, Rao's constant, intermolecular free length, and solvation number are computed. The results are analyzed on the basis of solute solvent interaction.

Key Words: Acoustical parameter, Rao's constant, Solvation number

Session: **TEB**

TRANSDUCERS, ELECTRO AND BIOACOUSTICS

TEB01- RAY ANALYSIS OF EMBEDDED SOLID CIRCULAR CYLINDER EXCITED BY A PLANE ACOUSTIC WAVE

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The acoustic pressure that acts on a hydrophone inside a sonar dome is of interest. The dome is a large thin-walled water-filled 3D FRP structure with reflecting and absorbing internal baffles. The pressure field inside the dome is caused by acoustic waves radiated by a distant target at sea. The waves are nearly plane when they reach the dome. A very large number of degrees of freedom are required to model the dome, and the water inside and outside the dome when using numerical methods. Therefore, in this paper, ray analysis that was used earlier to determine the pressure field inside embedded fluid cylinders, is extended to analyze the field inside solid circular cylinders embedded in an infinite exterior fluid. When a ray traveling in the water meets a solid, dilatation and distortion rays are transmitted and a longitudinal ray is reflected. When a dilatation or distortion ray traveling in the solid meets a solid-water interface, two rays are reflected and one is transmitted into the water. First, rays within the solid cylinder are traced to illustrate convergence, divergence, and caustics at which they intersect. The number of rays that have undergone n reflections within the cylinder is 2 power (n+1). Next, a method to determine eigenrays (rays that pass through a point of interest) is presented. More than one ray that has been reflected n times within the cylinder passes through some points. Finally, the stress and displacement within the cylinder are computed using ray theory. The computed values are in good agreement with those obtained using ATILA – a finite element package. The earlier work on embedded fluid cylinders and the present work can be combined to determine the pressure field inside water-filled sonar domes.

TEB02- ANALYTICAL MODEL OF AN ARRAY OF LANGEVIN TRANSDUCERS INCLUDING ACOUSTIC INTERACTION EFFECTS

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Planar arrays of acoustic projectors are used in sonar systems to radiate high acoustic power and echo-locate targets. The pressure field that is radiated by each transducer is determined by its characteristics, the electrical excitation, and the acoustic interaction between transducers that takes places through the surrounding water. Therefore, the pressure radiated by each transducer is not the same even when they are all identical and the same voltage is used to excite all of them. In this paper, a method is presented to determine the pressures radiated by an array of Langevin transducers including fluid-structure interaction effects. Each Langevin transducer is comprised of an axially polarized piezoelectric ceramic cylinder that is sandwiched between two elastic cylinders – the head and the tail. Exact linearized governing equations are used to describe each cylinder. Further, exact solutions to the governing equations are used. The force exerted by each transducer on the other transducers is determined by numerically integrating an analytical expression for its pressure field over the faces of the other transducers. The coefficients in the solutions are determined by simultaneously using the zero stress boundary conditions on the curved surfaces of the cylinders, continuity conditions at the flat interfaces between cylinders, the applied electrical potentials, and the acoustic interaction effects on the transducers. Then, they are used to determine

the frequency-dependent electrical impedance, velocity of the radiating face, and acoustic pressure radiated by each transducer. Numerical results are presented for an array of 6x4 transducers to illustrate the method and the effect of interaction on the radiated acoustic pressure field.

TEB03 - CORRELATION OF OBJECTIVE AND SUBJECTIVE DATA OF AUTOMOTIVE HORN

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Psychoacoustic analysis of automotive horn sound requires people's perception and engineering parameters. Human perception have considered based on a subjective test (Jury test). Engineering parameters (Psychoacoustic parameters) is calculated in an objective analysis. The current manuscript discusses the developing correlation between subjective data with psychoacoustic parameters of automotive horn. This correlation helps to predict user response for horn sound and optimize the number of Jury test at the design stage. Jury test yields rating values for various automotive horn sound samples. Pleasantness index values have computed from total sound pressure level, loudness, sharpness, roughness, fluctuation strength and tonality. A correlation study has done between pleasantness index value and subjective pleasantness.
Correlation methodology employs the use of principal component analysis to group the large number of psychoacoustic parameters into an appropriate orthogonal (principal) component. A "metrics profile" has computed for each sound based on the principal components. A transformation matrix has calculated from jury ratings and the metrics profile. The expected performance in jury rating has predicted using transformation matrix and psychoacoustic parameters.

Key words- Psycho-acoustics, Automotive Horn, Principle component analysis

TEB04- DETRENDED FRACTAL ANALYSIS OF EEG SIGNALS WITH MUSIC STIMULI OF CONTRAST EMOTIONS

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The objective of this study is to analyze quantitatively the effect of two different pairs of Indian classical music which are supposed to evoke contrasting emotions, on brain activity during the normal relaxing condition using electroencephalography (EEG). Two different sets of Hindustani music raga clips of contrasting emotion (romantic/sorrow) were used in the study. EEG was performed on two (2) male subjects while they listened to the clips. The analyses of their alpha and theta rhythms showed that in most cases arousal based activities were enhanced in both the subjects while they listened to the two music clips. EEG was taken with input stimulus of two different sets of Indian Classical music for 2 (two) subjects in a gap of 2 weeks. On the first day the two ragas chosen for our analysis were “Chhayanat” (romantic/joy) and “Darbari Kannada” (pathos/sorrow). In the following day the two ragas were chosen for our analysis were “Bahaar” (joy) and “MiankiMalhar” (sorrow/pathos). In our study, we used a nonlinear method called Detrended Fluctuation Analysis (DFA) to analyze the scaling behavior of the observed fluctuations in EEG. Also the number of alpha (α) and theta (θ) waves were extracted from the frontal (F3, F4, F7, F8 and Fz) and central (C3, C4 and Cz) electrodes. It is expected that the number or the variation of the alpha and theta waves will give an estimate of the alpha and theta power in the odd and even electrodes. The result of non-linear analysis differs from conventional linear techniques revealing better applicability of fractal method for obtaining meaningful result. The implications are discussed in detail.

Key words-Emotions, Indian classical music stimuli, EEG, Non linear analysis, DFA, alpha and theta brain rhythms

TEB05- ASSISTIVE TECHNOLOGY TO OVERRIDE POOR ACOUSTICS FOR MUSEUM VISITORS WITH HEARING IMPAIRMENT

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Acoustic conditions in Museums are not conducive for comfortable listening for visitors with hearing impairment. Longer reverberation time, noise created by other visitors etc. make it difficult for these visitors to listen to the curator, even with their hearing aids. Our country, being a signatory of UNCRPD resolution, has a legal binding to make museums accessible to persons with hearing impairment. This paper reports the design and development of an assistive device, which can be coupled through a neck loop to the user's own hearing aid, when they visit the museum. The device can store the commentary of about hundred exhibits, each for a duration of 3 to 5 minutes. The description pertaining to a particular exhibit can be heard through their hearing aids by dialing the code number of the exhibit through the numerical keypad of the device. The device can handle any language and is battery operated. The device is compatible with the hearing aids worn by persons with mild, moderate, severe or profound hearing loss, in tele-coil mode of operation. Feedback obtained from the field trials of the device, done on hearing impaired visitors at Regional Museum of National History, Mysore indicate comfortable listening by the user. Results also show that the technology provides a signal to noise of above 25 dB SPL even in the worst acoustic conditions.

Key words- Assistive technology, Museum, visitors with hearing impairment, noise, poor acoustics.

NANOFLUID INTERFEROMETER

(For Characterization of Nanofluids)
Nanofluid Interferometer generates sound wave in Nanofluids/Nano particles–Liquid Suspensions/Colloids of different concentrations at different temperatures. Ultrasonic velocity measurements provide important information about liquid state of substance. With the knowledge of Ultrasonic velocity one may find out adiabatic compressibility, molecular interactions, Hydration number, Hydrogen Bonding, Internal Pressure, Free Volume, Intermolecular Free Length, Miscibility, Compatibility and Glass Transition of Polymers, Phase Transition, Proton Relaxation Rate, Rao Constant Formalism, Relative Association (RA), Space Filling Factor, Specific Heat Ratio, Solvation Number, Surface Tension, Vander Waal's Constant,Wada Constant etc. Due to its versatility, it is being used for characterization and Practicals in several Institutions.

NANOFLUID HEAT CAPACITY APPARATUS

The Specific Heat of nanofluids decreases as nanoparticle concentration increases. The specific Heat of nanofluids increases with temperature. Thus future research are required to measure thermophysical properties of different nanofluids as a function of temperature and concentration. Our Nanofluid specific Heat Apparatus is a good tool for Research and Laboratory experiment for Nanotech Labs

LPHF SONICATOR

Low Power High Frequency (LPHF) Sonicator facilitates a novel ultrasound irradiated solution cast technique for the synthesis of gel nano composites etc. It provides uniform stirring by ultrasound at desired temperatures. High frequency variation (2&3MHz) with controllable energy make possible uniform dispersal of nanodispersoid at microlevel.This technique is superior and different from conventional ultrasonicators, in which due to high energy, non uniform dispersion is obtained. In conventional Sonicators, frequency used is 20-40 KHz, hence wavelength is large, therefore, ultrasound waves see the solution as continuum and hence uniform dispersal can not be obtained. Further, due to high energy of ultrasonic waves, there may be possibility of chemical reactions too. Thus ultrasonic irradiation technique of LPHF Sonicator will make a homogeneous solution at elevated temperature.

EQUIPMENTS FOR MATERIAL SCIENCE, PHYSICS & CHEMISTRY

- **Ultrasonic Interferometer •Young's Modulus Apparatus by Piezoelectricity**
- **Dielectric Constant Kit • Curie Temperature Kit •Capacitance and Permittivity Kit**
- **Universal B-H Curve Tracer • Forbidden Energy Gap Kit • Boltzman Constant Kit**
- **Lattice Dynamic Kit • Stefan's Constant Kit •Cooling Curve Kit • Optical Fiber App.**
- **Heat Capacity Kit • Laser Experiment Kit • Semiconductor Laser Apparatus**
- **Photodiode Characteristic App. •LED And Laser Diode Characteristic Apparatus**
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Session: **SP**

SPEECH

SP01- VOICE CHARACTERISTICS IN STREET CHILDREN (VENDORS)

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Social groups make use of speech in their interpersonal relations within familiar, social, leisure, and work settings. Living and working conditions may interfere and change t professional use of speech, quality of voice, and quality of health in specific groups. Vocal performance in children varies considerably and this can be partly due to differences in living conditions between individuals. In developing countries like India there are more than 400,000 children who live and work in the streets. Among these nearly 20% of children are street vendors. Child labor at street level brings potential physical and psychological stress to the children during their vulnerable period where the structural organs of speech production system are not fully matured. Link between street-living situation and quality of voice and the evaluation of the impact of voice quality on health condition are not well understood. The objective of the study was to determine the voice characteristics of children engaged in street selling, which involves an essentially professional use of voice in this group as opposed to a group of children without this experience. Two groups of children were participated in the study. Group (experimental) consisted of 20 male children with in the age range of 10- 14 years who had minimum of 1-2 years of selling experience. Group II (control) consisted of 20 age and gender matched children without any selling experience (school going children). Both groups were interviewed and using DAT recorder, samples were recorded. MDVP software (CSL, 4500 Model) was used to measure MPD, s/z ratio, F0, Jitter, Shimmer, HNR, vF0 and SPI. Results revealed significant differences in acoustic measures on few parameters between children who are street vendors and the control group. Acoustic analysis revealed the deviant voice characteristics of children who use their voice for selling compared to school going children. The results of the present study augment the voice therapists/ specialists in planning tailor-made intervention program, especially for children engaged in selling.

Key words- Street children, school children, voice characteristics.

SP02- RATE OF SPEAKING/READING OF ADULT NEPALI SPEAKERS

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Rate of speech is one of the important aspects of fluency. Any disruptions in rate of speech will lead to disturbances in speech fluency and it has direct effect on the intelligibility of speech. The rate of speech may depend upon several factors such as coordination between speech subsystems, language competence, and the contextual factors and it can be an index for measuring the speed of articulatory movements during speaking. Although normal rate of speech is reported to be in the range of 80-180 words per minute, the mean values vary from language to language. Nepali, an Indo-Aryan language, is the language spoken widely in Nepal by approximately 17 million people. Although it is one of the important languages of Indo-Aryan family, not many studies are available about the characteristics and features of Nepali language. Hence, the present study was carried out with an aim of understanding the rate of speaking/reading of young Nepali speakers. 20 young (10 males and 10 females) native Nepali speakers in the age range of 20-30 years were taken for the present study. Rate of speech was measured using job task in which participants were asked to speak about their job for not less than 100 words or for 2 minutes. For measuring rate of reading, participants were asked to read a story passage in Nepali language with 256 words and 688 syllables at their comfortable speed. All the samples were recorded using PRAAT V4.0 software and the silent pauses with more than 150 ms were removed

from the sample. The total duration and total number of words in both job task and reading task were measured. Rate of speech and reading were measured as words per minute (WPM), syllables per minute (SPM), and syllables per second (SS). Analysis of speech samples of job task revealed higher rates of speech in males than that of females. Similarly, in rate of reading measures, higher rates were found in males compared to females although statistically not significant. Comparison between the tasks revealed significantly higher rates in reading compared to speaking. The present study has established normative data for rate of reading and speaking in Nepali language. The present study also found that rate of reading is faster than that of rate of speaking in both males and females in Nepali. This may be due to the additional cognitive demands during job task than that of reading task. The results of the present study can be helpful in diagnosing some of the fluency disorders in Nepali language.

Key words - Nepali, rate of speech, rate of reading, words per minute, syllables per minute

SP03- VOICE PARAMETERS OF CHILDREN WITH DOWN SYNDROME USING MULTI-DIMENTIONAL VOICE PROGRAM

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Down syndrome is a chromosomal disorder that shows an unusual quality in voice with phenotypic characteristics includes maxillary hyperplasia, hypotonia with macroglossia which contribute to acoustic alterations. This study is to understand the differences between voice parameters of children with Down syndrome and that of normal children analyzed acoustically and perceptually using MDVP and CAPE-V wherein CAPE-V was analyzed by three experienced SLPS. 15 children who were diagnosed as Down syndrome between age range of 6 to 12 years were asked to vocalize and sustain /a/,/i/ and /u/ vowels for at least 3 seconds at their comfortable pitch and constant loudness. Recording was carried out in a quiet room with microphone where mouth to microphone distance was kept constantly at 10 cm and 45 degree axis positioning. Voice was recorded and middle portion of the phonation was extracted. 15 age and gender matched typically developing children's voice were compared with the Down Syndrome children. The results revealed that majority of the voice parameters were abnormal in children with Down syndrome. The results of the present study would augment during counseling procedures and to plan and implement tailor-made treatment for children with Down syndrome, especially with respect to voice.

Key words- Acoustic analysis, developmental disorder, Fundamental frequency, Voice

SP04- ACOUSTICAL & PERCEPTUAL EFFECT OF AGE & GENDER ON VOICE OF INDIVIDUALS BETWEEN 4 TO 18 YEARS

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Acoustical & perceptual analysis of voice has been the research interest since decades. There have been lot of attempts in past to study effects of age & gender of voice in adults, but very few studies are carried out on pediatric population in Marathi speaking individuals. The objective of the study was to explore the acoustical and perceptual effect of age and gender on voice of individuals between 4 to 18 years of age. A total of 42 participants were selected divided into 7 age groups, consisting 3 males and 3 females in each. Voice samples were recorded using a digital tape recorder for tasks of sustained vowel phonation and picture description. Acoustic analysis was carried out using MDVP (CSL4500). Perceptual analysis was carried out by 15 untrained naive listeners and 15 trained listeners on a perceptual rating scale to identify age and gender of the individual's voice. Mean fundamental frequency (mf0) varied as a function of age and gender for both tasks. Jitter and noise related parameters (NHR, VTI) showed non linear trend across age and gender. Perceptually, gender identification scores were better as compared to age identification scores with males being correctly identified at a higher (%) rate as compared to their female counterparts. Future studies can explore changes in formants across different speech tasks and larger number of listeners can be added for perceptual analysis.

Key words- Acoustic, perceptual, fundamental frequency, age, gender.

SP05- BENCHMARK FOR SPEAKER IDENTIFICATION USING LINEAR PREDICTION CEPSTRAL COEFFICIENTS (LPCC) ON VOWELS IN KANNADA LANGUAGE: A PRELIMINARY STUDY

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Identification of people by their voices is a common practice in everyday life (Rose, 2002). It is important to include research concerned with establishing parameters for speaker verification because of the legal consequences and forensic involvements associated with the application of related research. There is research which has instigated as to what percent matching would indicate similarity/dissimilarity of speaker or various features for speaker identification is not established using only Machine methods. Vowels, nasals and fricatives (in decreasing order) are commonly recommended for voice recognition because they are comparatively easy to identify in speech signals and their spectra contain features that reliably distinguish speakers based on semi automatic methods. In this perspective the aim of the present study would be to obtain the percentage of speaker identification using vowels in Kannada speaking individuals. The participants chosen for the study would be ten Kannada speaking neuro-typical adults, constitute as Group A. This would be further sub grouped as Group B constituting five males and Group C constituting five females. A total of these ten participants will be in the age range of 20-30 years. The material will be eight commonly occurring, meaningful mono-, bi-, and/or multisyllabic Kannada words containing long vowels /a:/, /i:/ and /u:/ embedded in hypothetical forensic sentences. These long vowels will be truncated from the words embedded in the hypothetical sentences using the PRAAT software. Each vowel would be subjected for Linear Prediction Cepstral Coefficients (LPCC) and Mel Frequency Cepstral Coefficients (MFCC) using Speech Science labwork bench for Semi-automatic speaker recognition (vocabulary dependent) software. The results of the present study would probably indicate the high or low proficiency in speaker identification using LPCC on comparison with MFCC. Thus, the present study attempts and provides some insights to examine the efficiency of semi automatic methods in finding the benchmark for long vowels in Kannada language. Although the study is done in a laboratory condition, the preliminary results would suggest the employability of these measures in the area of forensic sciences. The obtained benchmark would serve as potential measure for Speaker Identification in the forensic sciences and the comparison between the two coefficients would be discussed.

Key words- Bench mark, Forensic, Cepstral coefficient, Speaker Identification

SP06- F_0 CHARACTERISTICS OF PROFESSIONAL NEWS-READERS IN CONTEXT OF VARIED EMOTIONAL NEWS ITEMS

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The objective was to profile F_0 characteristics of news-readers on varied emotional texts. 15 professional news-readers and 15 non-news-readers were the participants. The participants read the news bulletin that conveyed different emotions (shock, neutral, happy, sad) in a habitual and 'news-reading' voice. Speaking Fundamental Frequency (SFF) and Standard Deviation (SD) of SFF were extracted from 1620 tokens using PRAAT on the opening lines, headlines, news stories and closing lines of each news item. Independent t test and Friedman test were used for statistical analysis. Both female and male news-readers had significantly ($p \leq 0.05$) higher SD of SFF in 'news-reading' voice than speaking voice in all types of emotional text. The opening line in male news-readers had low F_0 when compared with the rest of the texts. This was in an opposite trend in female news-readers. No significant difference was noted in SFF of speaking voice and 'news-reading' voice in male non-news-readers. SD of SFF in male non-news-readers was significantly higher for 'news-reading' voice while reading happy and sad news. However, in female non-news-readers, it was significantly higher in all emotional news. SFF in speaking voice was not significant between news-readers and non-news-readers of both genders. SD of SFF was higher in news-readers than in non-news-readers, however, was not significant statistically. F_0 characteristics determine the amount of vocal alterations exercised by news-readers

while reading bulletins. This information is highly pedagogic for training voices for this profession.

Key words - News broadcasters, Speaking Fundamental Frequency, Standard Deviation (SD) of SFF.

SP07- ACOUSTIC ANALYSIS OF VOICE IN MICROLARYNGEAL PHONOSURGERY AMONG VOCAL POLYP PATIENTS

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The objective measurement of acoustic voice analysis among patients of pre and post vocal polyp microlaryngeal phonosurgery. Forty patients (20 male and 20 female) with unilateral vocal polyp were included. The age range was from 27 to 48 years with mean age 39.4 years. The therapy session at least two therapies (one/week) before surgery and second vocal assessments were done between third and fourth week after micro-laryngeal surgery (MLSx). Those patients who did not meet the above criteria were omitted from the study. The acoustic samples were recorded with Dr. Speech software (Tiger Electronics, USA). The microphone was kept at a constant distance of 15 cm from the subjects' mouths and they were asked to enunciate a sustained /'a'/ at the optimal pitch level and repeated several times. Fundamental frequency and MPT increase significantly after MLSx in all male and female patients, but in female patients the jitter value was decreased significantly after MLSx. Shimmer value decreased after MLSx by 10%, which is significant. Uzola also found significantly reduced values of jitter and shimmer after MLPS. The HNR does not show significant difference in both pre and post MLSx (p=0.115 in female & 0.796 in males). This study concluded that the acoustic voice analysis techniques provide an objective, reproducible and measurable data of vocal function. The dysphonic voice due to vocal polyps is documented and following the MLPS improvement is confirmed.

Key words- Microlaryngealphonosurgery (MLPS), Microlaryngeal Surgery (MLSx).

SP08- VOWEL ACOUSTICS IN SURGICALLY TREATED ORAL CARCINOMA

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The aim of this study was to analyze and compare vowel acoustics of participants of surgically treated oral carcinoma with normal age matched subjects. Three group of participant were enrolled in the study. Group1 consisted of two male participants who had undergone total glossectomy with flap reconstruction for defect of the primary lesion, Group2 included a participant with combined left maxillectomy and hemi mandibulectomy and Group3 was 16 normal male participants (age range 40-65 years). Vowel prolongation and sentence repetition were used as stimulus. Vowel acoustics (formants, formant range and vowel space) were derived by using PRAAT software. There was substantial difference in the selected vowel acoustic parameters of group 1 and group 2 compared to group 3. The difference was greater with respect to the f1, f2, formant range of vowel /i/ and vowel space. Group 1 had reduced formant range of /i/ when compared to the other two groups. However vowel /u/ formant range was reduced for group 2. The current study highlights the impact of various surgical procedures of oral carcinoma on vowel acoustics. The deviation in vowel acoustics observed can be attributed to variation in the length and resonance properties of oral cavity resulted from the surgical intervention. The study has implication with respect to highlight the importance of including vowel acoustics as valid measure for documenting the efficacy of speech rehabilitation and prosthetic management.

Key words- Vowel acoustics, Total Glossectomy, Combined Maxillectomy and Madibulectomy

SP09- PERCEPTION OF NATIVE AND NON-NATIVE PHONEMES BY MALAYALAM LISTENERS

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The present study was aimed at investigating perception of

native and non-native phonemes by Malayalam listeners in quiet and noise. Fifteen native Malayalam listeners who had English as medium of instruction at school participated in the study. Stimuli consisted of 16 vowel-consonants-vowel (VCV) non-sense syllables spoken by eight native speakers of Malayalam and ten native speaker of American English. The non-sense syllables comprised 16 consonants(/p/,/t/,/k/,/b/,/d/,/g/,/m/,/n/,/f/,/v/,/s/,/z/,/r/,/l/,/ʃ/,/ʧ/) in intervocalic context, the vowel preceding and following the consonant was always /a/. To investigate phoneme identification in noise the syllables were mixed with speech-spectrum-shaped noise at a signal-to-noise ratio (SNR) of 8, 0, and -8 dB. Phoneme identification task was carried out as 16 alternative forced-choice procedure and the responses were stored as confusion matrix. The syllables were randomly presented binaurally and participants were encouraged to identify the consonants as accurately as possible. The data was subjected to Sequential Information Transfer Analysis and information transfer was analysed based on place and manner of articulation, and voicing. The mean phoneme identification score in quiet and 8 dB SNR was found to be higher for native phonemes, while at 0 and -8 dB SNR score was better for non-native phonemes. This finding was unexpected and suggests that the phonemes spoken by Malayalam speakers are more susceptible to effects of noise. Further, information transfer analysis across features showed that manner of articulation information was transferred better than place of articulation and voicing across the conditions for both native and non-native phonemes, while transfer of voicing information was severely affected.

SP10- VOICE ONSET TIME (VOT) IN MALAYALAM SPEAKING CHILDREN WITH AUTISM SPECTRUM DISORDERS.

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The present study sought to investigate voice onset time (VOT) in Malayalam speaking children with autism spectrum disorders (ASD) and typically developing children. A total of 8 children with ASD in the age range of 6-12 years (N=4; Group I) and 12-18 years (N=4; Group II) were recruited as participants. They were instructed to repeat 3 Malayalam words beginning with unvoiced stops 5 times. The obtained sample was recorded and acoustically analyzed for VOT. The results show that lag time decreased with tongue advancement in ASD and typically developing children. This is in consonance with the earlier studies by Volaitis and Miller (1992) and Auzou et al. (2000). Nevertheless, this was not observed in Group I of children with ASD. In addition, VOT was found to be lower for Group I than Group II; and all the unvoiced stops were characterized by lag VOT. This supports previous research on development of voicing contrasts by Savithri, Pushpavathi and Shastry (2007). Further, the typically developing children had increased VOT as compared to children with ASD. Future cross-linguistic and cross-clinical population studies are warranted.

Key words- Lag time, Voice-onset time, Autism Spectrum Disorder, Unvoiced stops

SP11- TRANSITION OF COARTICULATION FROM PRELINGUISTIC TO EARLY LINGUISTIC PERIOD

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Coarticulation refers to the fact that a phonological segment is not realized identically in all environments, but often varies to become more like an adjacent or nearby segment. The effects of coarticulation often extend well beyond the boundaries of a particular segment and appear to be the influence of both spatial and temporal linking of articulatory gestures. There are various methods to quantify the coarticulatory patterns including imaging techniques and acoustical analysis. Locus equation is an acoustic method to analyse coarticulation using linear regressions of the frequency of the second formant transition sampled at its onset and mid point. Appropriate coarticulation indicates the maturation of oral speech motor control and this maturation occurs during childhood. In this perspective, the present study addresses the question of coarticulatory changes across places of articulation in very young children. Participants included 20 typically developing native Malayalam speaking children in the age range of 6-18 months and they were divided into two groups; 6-12 months and 12-18 months.

Each group comprised of 10 children including 5 males and 5 females. The target CV productions (voiced stop consonants /b/, /d/, /g/ in the context of vowels /a/, /i/, /u/) were selected from the audio recorded samples. The samples were subjected to acoustical analysis using PRAAT software (Version 5.1.14).The findings augment the theoretical knowledge of SLPs on coarticulation during pre and early linguistic stages.

Key words- locus equation, pre-linguistic, early-linguistic, coarticulation, Malayalam

Session: **SDP**

SOUND PERCEPTION

SDP01- BRAINSTEM ENCODING OF DYNAMICALLY CHANGING VIRTUAL PITCH IN HARMONIC COMPLEXES

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The aim of the present study was to compare the ability to track a change in fundamental frequency (F0) during its presence and absence in a complex tone. The frequency following responses (FFRs) were recorded for two complex tone glides from 8 individuals (age range = 17-20 years, females). Both the stimuli were of 170ms duration and had their F0 gliding from 100Hz to 200Hz. The first complex tone (CT) consisted of 1^{st} to 15^{th} harmonic while the complex tone with missing fundamental (CT MF) consisted of 6^{th} to 15^{th} harmonic. FFRs were recorded for these stimuli using Neuroscan Scan 4.4 software, Synamps^2 amplifier. The FFRs to both the stimuli were analysed using Brainstem Toolbox in Matlab. Results suggest that the dynamically changing pitch is well encoded in the human auditory brainstem even in the absence of the fundamental frequency and the lower order harmonics (<6), and this can be recorded with scalp recorded FFRs. However, pitch tracking and stimulus to response correlation improved in the presence of lower harmonics and fundamental. This study provides the evidence for neural basis of pitch perception in the presence and absence of lower harmonics and fundamental.

SDP02- COMPARISON OF THE EFFECTIVE COMPRESSION RATIO AND THE NOMINAL COMPRESSION RATIO IN HEARING AIDS

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Compression ratio (CR) of a hearing aid has an effect on the speech perception. Hence, optimizing this is very essential for successful hearing aid fitting. The CR is influenced by many factors such as, time constants, number of channels and the type of input signal. The CR has been found to be lesser for a speech signal (effective CR) than for a tonal signal (nominal CR). Therefore, the compression ratio that is displayed in the programming software may not be the same as that of the effective CR, resulting in a difference in speech perception. The present study aimed to measure the effective CR for sentences in Kannada language and compare it with that which was set during programming the hearing aid. A two channel hearing aid, programmed for a moderate flat SNHL, was set to CR of 2:1 and 3:1, and short and long release times. Ten Kannada sentences were presented using Cubase software to a loud speaker located at 1 meter distance from a SLM at 45 degree azimuth. These sentences were recorded with different combinations of the CRs and release times at 55, 65 and 85 dB SPL. The effective compression ratio was found out from the recorded sentences. The results revealed that the effective CR was considerably lower than that given in the programming software. The results are presented across different compression ratios, time constants and different input levels. The results of the study will have applications in the routine selection of hearing aid parameters.

SDP03- NEURAL REPRESENTATION OF DIFFERENT SPEECH STIMULI AT CORTEX IN INDIVIDUALS WITH NORMAL HEARING

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Different speech stimuli neural representation at cortex can be measured using electrophysiological techniques,

which is named as speech evoked cortical potential. A different component of cortical potentials which is complex in natures shows the time varying temporal and spectral cues. There is a change in neural representation of different speech stimuli in terms of latency and amplitude measures could be due to maturation in different age groups individuals. Hence, the aim of the present study to find out differences in neural representation due to different speech stimuli (/m/, /t/, & /g/) in children and adults at 65 dB SPL intensity levels. There were 10 children with normal hearing in the age range of 5-7 years and 10 adults with normal hearing in the age range of 17-24 years selected for the study. Speech evoked cortical potential were recorded using HEAR Lab (version 1.0) auditory evoked potential system. Non-parametric tests were used for statistical analysis for data collected from children and adults groups. Mann-Whitney U tests shows statistically significant differences between children and adults for latency and amplitude measures of wave P1 and N1 at 0.05 levels. However, Kruskal Wallis test did not show any significant differences across different speech stimuli for children and adults at 0.05 levels. The above results probably reflect a similar neural representation of different speech stimuli in children and adults.

SDP 04- COGNITIVE PROCESSING AND PERIPHERAL SENSORY CODING IN INDIVIDUALS WITH NORMAL HEARING SENSITIVITY

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Some listeners with normal hearing reported communication difficulties in some settings where there are competing sound sources. The reasons for such difficulties are debated between cognitive processing and peripheral sensory coding. In the present study we examined cognitive processing (working memory) and peripheral sensory coding (i.e Frequency discrimination (DLF), interaural time difference (ITD) and spatial selective attention task (SSA) in 10 listeners with communication difficulties in some settings along with controls who reported no communication difficulties. DLF and ITD tasks were performed using maximum likelihood procedure implemented in MATLAB. In the spatial selective attention task participants heard three digits presented from +20°, -20° and from centre simultaneously. They were instructed report the digits heard from the centre. Results showed that participants who had poor DLF (> 15 Hz) also performed poorly on ITD task and SSA. However, more data is required make a conclusion on the same.

SDP05- AGE RELATED DIFFERENCES IN SOME PSYCHOACOUSTICAL ABILITIES, SPEECH PERCEPTION IN NOISE AND WORKING MEMORY

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Age related decline has been observed in various psychoacoustical abilities and speech perception in noise. However all these abilities has not been studied in a single individual and whether this decline could be attributed to decline in cognitive abilities namely working memory has also been not studied. In the present paper age-related effects on psychoacoustical abilities, speech perception in noise and working memory were compared between younger and older subjects with normal hearing sensitivity. Younger subjects were between 18 - 25 years of age and older subjects between 40 - 65 years. Seventeen subjects were tested in each group. Psychoacoustical abilities were assessed through differential lime of frequency (DLF for 500, 1000, 2000 and 4000 Hz) , differential limen of intensity (DLI for 500, 1000, 2000 and 4000 Hz), duration discrimination task, gap detection task, modulation detection thresholds (4, 8, 16, 32, 64 and 128Hz), duration pattern test and backward masking. These tests were done using mlp procedure in matlab. Speech perception in noise was assessed through Quick SIN in Kannada. Working memory tasks involved auditory digit span task, operation span and reading span task. The results showed that the younger individuals performed significantly better most of psychoacoustic measures, speech perception in noise and working memory in comparison to older age groups. However, there was no significant difference between two groups in DLI at 2000 Hz, duration discrimination test, modulation detection for 8, 16 and 32 Hz, and operation span task.

SDP06- FAST FOURIER TRANSFORM ANALYSIS OF SPEECH PROCESSED AT SUBCORTICAL LEVEL IN CHILDREN AT RISK FOR CENTRAL AUDITORY PROCESSING DISORDERS

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Central auditory processing is the processing of complex sounds after the initiation of transduction of sound energy via external ear into neural activity of the cochlea. Disruption of central auditory processing may lead to deficit in perception of speech, environmental sound or music in the absence of peripheral hearing loss. The present study was carried out to assess the coding of fundamental frequency and different harmonics using speech evoked auditory brainstem responses. Thirty children at risk of central auditory processing deficit were compared with age matched typically developing children in the age range of 8-14 years. The responses were analyzed offline using Fast Fourier Transform with the help of MATLab (version 7.0) software. Statistical analysis was done using ANOVA. The result revealed no significant differences between ear and hence both ears data were combined. Further results showed there was no significant main effect for fundamental frequency (F_0)[F(1, 118)= 0.122; p=0.727], whereas statistically significant main effect observed for second harmonics (H_2)[F(1, 118)= 14.494; p=0.000], third harmonics (H_3)[F(1, 118)= 4.822; p=0.029] and fourth harmonics (H_4)[F(1, 118)= 7.332; p=0.008]. These findings suggest that probably their pitch encoding is intact whereas the harmonics are compromised. The differences between two groups in terms of harmonics was attributed to brainstem timing deficit in children at risk of central auditory processing disorder in comparison to typically developing children.

Key words- Pitch encoding, Speech evoked ABR, CAPD, Fundamental frequency.

SDP07- PROCESSING OF EASY AND DIFFICULT PHONETIC CONTRASTS BY NATIVE LISTENERS: A P300 STUDY

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Phonological status of the phone determines the ease with which a phone can be identified or discriminated. Studies have shown that phonemes can be identified with greater ease than that of allophones. However, little is known about the cortical representation of such behavioral manifestation. Hence, the present study investigated the behavioral identification of four pairs of Malayalam phones which included two pairs of phonemes (/l/ - /ɭ/ and /r/ - /ɻ/), one pair of acoustically similar phones (/t̪/ - /t/) and a pair of allophones (/n̪/ - /n/). A multichannel recording of auditory event related potential, P300, was done for these four pairs of phones in CV syllables. Twenty native speakers of Malayalam with normal hearing sensitivity participated in both behavioral and electrophysiological experiments. The results of behavioral experiment revealed that phonemes were identified with greater accuracy followed by the acoustically similar phones and last by the pair of allophones. Latency and amplitude of P300 also showed similar trend as that obtained in the behavioral experiment. That is latency was shorter and amplitude was higher for phonemic pair than acoustically similar pair followed by allophonic pair. However, statistically, only P300 obtained for /n̪/ - /n/ pair was significantly longer than that obtained for the phonemic pairs. Thus, the latency of P300 reflected the ease of behavioral identification by the listener as well as the phonological status of the phone.

Key words- Phone identification, auditory P300, phonological status.

Session: **MA**

MUSIC ACOUSTICS

MA01- IDENTIFYING EMOTIONS THROUGH RAGAS: AN EXPLORATORY STUDY

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Music means the act of coloring the mind or emotions of an individual with the emotion of raga. Keeping in view the limited research on effects of music training, on emotional development, the present study was planned to find out the effect of music training on depicting emotions conveyedthrough Ragas. A set of tones (Pakad) of seven Ragas sung by a professional singer were recorded. Recording was done in quiet environment with fixed speaker to microphone distance. Twenty trained (Group I) listeners and 20 (Group II) untrained listeners participated in the study. Participants (Group I) were trained for one hour each every day for a week by trained professional. All the participants carried out perceptual analysis to identify different emotions depicted by the different ragas. The comparison was done to see which group was better in identifying the emotions. The results indicated that individuals who had music training could identify the emotions through ragas better than that of individuals who do not have music training. Anger, happiness and devotion were the most accurately identified emotions by both the groups. The study implies that music training definitely is capable of improvising supra segmental aspects to understand the underlining emotions in speech. The results of the study highlight the importance of combinations of different musical tones to highlight the superimposed emotions in speech.

Key words- Melody, Rasas and prosody

MA02- ACOUSTICAL SIGNATURE ANALYSIS OF VOEN

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Voen is an air-column woodwind musical instrument which contains the series of small size circular tubes arranged on a circumference of a large round tube. Voen instrument is widely used in Thailand. Voen consists of eleven tubes of different diameter and length, and each tube has different end termination conditions. The aim of the current study to understand the acoustical behavior of the instrument and relate to the geometrical information of tubes and end terminal conditions. Sound from Voen recorded and played back for acoustic analysis studies. Fast Fourier Transforms (FFT) of the recorded sound have been analyzed to calculate the resonant frequency of tubes and the musical notes. The experimental resonance frequencies have compared with theoretical and the standard musical note frequencies. It is observed a good correlation between experimental and theoretical results.

Key words- Wind Instruments, Acoustic Measurements, Signal Processing

MA03- ACOUSTIC AND MATERIAL CHARACTERIZATION OF SYAHI USED IN THE INDIAN PERCUSSION INSTRUMENT TABLA

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The *tabla* is a percussion instrument that comprises of two drums played by striking membranes loaded with *syahi* and stretched over wooden or metal pots called *khod*. Traditionally the *syahi* is prepared by mixing an adhesive with a finely ground black stone powder found in the Bhavnagar region of the state of Gujarat in India. Geologically the stone is named Psilomelene also known as Black Hematite which is a group name for hard black manganese oxides such as Hollandite and Romanechite. The *syahi* which is applied while making the *tabla* is prepared using 80% of the aforementioned stone powder, finely ground, along with a traditional adhesive called *khal* – a boiled thick paste of refined wheat flour and water. This article discusses the change in percussion characteristics viz. the spectral analysis of *tabla* membranes by replacing the traditional black stone powder with laboratory grade manganese dioxide that is easily available in the market.

Spectral analysis over two different compositions that show a marked shift in the percussion frequencies is discussed.

MA04- TIMBRAL DIFFERENTIATION OF WESTERN AND INDIAN STYLE VIOLIN SOUNDS

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Violin is basically a western instrument which was introduced in India by the British bandmasters. Violin tuning-playing and posture has been changed later by the Indian musicians. It is also fact that, there has been a huge difference in the making of Indian and western violin, though the shape and size are same or almost same. So it is expected that there might be some differences in the quality of sound (timbre). Here in this study, we took four violins out of which three are Indian and one is of western (Italy make) style. This research work is mainly on finding timbre representation which is built upon spectral parameters extracted from samples of sounds of four open strings each from four violins in three modes of playing (viz. plane/continuous bowing, staccato and pizzicato). So we have a database of 4x4x3=48 monophonic sound samples. Amplitude and frequency of each partial were measured by Fast Fourier Transformation. Timbre parameters and spectral features are being calculated using those data. Some statistical analysis is also made based on these parameters. The major spectral features are pitch, harmonic shift and formant frequencies and the main timbral features are brightness, inharmonicity, centroid, odd to even harmonics, tristimulus values and irregularity. A relationship between the lower frequency fundamental energy and the higher frequency harmonic structure in violin was observed. Formant frequencies and distance between two successive highest peaks are also important features to compare the sound characteristics of four violins. We used Euclidian distance function to measure the closeness of the sound characteristics of the four violins. These timbral and spectral features are used to analyze sound source characteristics of violin and are helpful in comparing the sound quality of foreign made and Indian made violin.

Key words- Violin, timbre, timbre parameters, formant, spectral features, closeness

MA05- EFFECT OF REVERBERATION ON ACCEPTABLE NOISE LEVEL UNDER DIFFERENT BACKGROUD CONDITIONS

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The aim of the present study was to investigate the changes in reverberation time on acceptable noise level (ANL) in adults with normal hearing and those with hearing impairment (aided and unaided conditions) in the presence of different background stimuli. Fifteen adults with normal hearing and fifteen adults with bilateral symmetrical mild-moderately severe SNHL participated in the study. ANLs were established for non-reverberated and digitally reverberated (RT=0.4, 1.2, and 2 sec) primary talkers under two conditions; with Kannada multi-talker babble and with instrumental music sample as background stimuli for both the groups. The tests were conducted under unaided and aided conditions for those with hearing impairment. Statistical analysis revealed that ANLs were better for individuals with normal hearing; and aided ANLs were better than unaided ANLs for those with hearing impairment. This trend was same in case of instrumental music and multi-talker babble background stimuli. ANLs were better for music stimuli than for multi-talker babble; i.e., participants were more willing to accept music as background stimuli than multi-talker babble. Music seemed to be processed differently as a background stimulus than multi-talker babble. This may be associated with auditory stream segregation. Auditory signals of different timbre (primary talker and music) are easier to segregate than those of similar timbre (primary talker and multi-talker babble).

Key words- reverberation time, acceptable noise level, multi-talker babble, music stimuli, hearing impaired.

MA06- EFFECT OF SHORT-TERM MUSICAL TRAINING ON AUDITORY CORTICAL RESPONSES

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The cortical areas of the brain are highly sensible for slight changes in the reception of any sensory input. Long term musical training induces both structural and functional plastic changes in the cortex. The study aimed to investigate the short-term perception of musical training and its effect on the long latency response (LLR) for speech and music stimuli. A total of 20 normal hearing adults (4 females) participated in the study. The participants were amateur or rare listeners of Indian classical music. Long latency response was recorded for speech stimuli /da/ and for music stimuli. Participants were asked to listen to violin song played in two Carnatic ragas for 30 min for a period of 8 days. Cortical responses were recorded again after the perceptual training. The results reveal that there was statistically significant difference in latencies P2 and N2 peaks and amplitude of N2 between pre and post exposure recordings. These results show that even the short-tem musical training can induce plastic changes in the auditory cortical neurons.

Key word- Speech stimuli, Music stimuli, short –term perceptual musical training.