



Experimentally Speaking ...

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Message from the President

Promoting Creative Thinking in SEM

A number of years ago my good friend and colleague at UBC, Frank Navin, wrote an interesting and inspirational article about creativity. The title of his article was "Engineering creativity – doctum ingenium." There are two sentences in his article that I have always remembered: "Creativity is the prerogative of humans. Human creativity uses what already exists and changes it in unpredictable ways that bring about a desired enlargement of human experience that goes beyond the usual choices." I have read Frank's article several times over the years because it reminds me of the need to bring to the classroom a balance between the

traditional convergent "vertical" thinking, which is prevalent in engineering education, and creative "lateral" thinking. The need for this balance, not only in our educational system, but also in the way we do business, is due to the fact that professional and economic success in today's competitive global environment depends upon innovation and creativity. Society expects its engineers to add to the growth of our economy with their creative contributions.

Creativity is our prerogative to use what already exists, and allows us to make changes in unpredictable ways. Creativity is beyond ordinary thinking because we can expand our experience by going beyond the traditional choices available to us. We all experience great satisfaction when creativity helps us develop a new and unexpected solution to a particular problem that does not have simple obvious answers. However, creativity, as opposed to innovation, is not as prevalent in engineering as it is in the arts. In his article, Frank wrote that the actual number of truly creative ideas that engineering researchers consider unique ranges from about one in 5 years to one in 10 years. The number of such ideas from practising engineers is thought to be one in 10 to 20 years. In contrast, the production of truly unique ideas by artists was roughly three to four per year.

The literature about the creative process is very rich and a number of methods have been developed to assist individuals to generate ideas. Methods such as brainstorming, synectics, or more systematic morphological approaches are available. The key elements of all the methods are to prepare your mind (creative thinking) and to postpone evaluation (convergent thinking) for as long as possible to increase the number of ideas. But those ideas must have value, not just be different, and should be a provocation opposite to normal thinking. We can then they say that creative thinking is a skill that can be nurtured and not a matter of individual talent. We know that creative thought depends on intuition, but we do not know what creative "button" to push, or even if the creative "button" exists. However, this should not discourage our attempts to find better methods to foster creative engineering and avoid premature judgment of ideas. It may be used to increase the usefulness of vertical thinking. This means that we can use such ideas to seek a solution by traditional vertical thinking. And there is no doubt that the results of creative thinking must eventually be consistent with logical or mathematical thinking. Generating creative and innovative ideas is satisfying for the individuals involved. Such ideas can stimulate the

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IMAC-XXXI

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February 2013 • Garden Grove, CA, USA

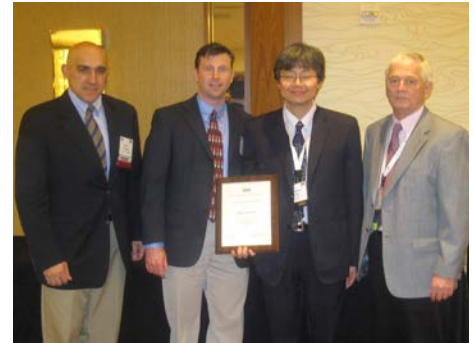
Some highlights from another successful IMAC:



Carlos Ventura, SEM President;
Jean-Philippe Noel, D.J. DeMichele
Scholarship Recipient; and
Al Wicks, IMAC Conference Chair



(clockwise from bottom) Julius Bendat,
subject of the IMAC Honorary
Session; his daughter, Cindy;
his son, Jim; his daughter-in-law,
Marilyn; and his wife, Millie



Carlos Ventura; Colby Galloway and
Shen-En Chen, D.R. Harting Award
Recipients; Al Wicks



Carlos Ventura; Charles Farrar, D.J.
DeMichele Award Recipient; Al Wicks



Al Wicks; Alexander Vakakis, IMAC
Keynote Speaker; Carlos Ventura



Carlos Ventura; Randy Mayes,
G.A. Brewer Award Recipient; Al Wicks



Carlos Ventura; David Brown, SEM
Fellow; Al Wicks



Carlos Ventura; Keith Worden, IMAC
Plenary Speaker; Al Wicks



Carlos Ventura with just a few of
David Zimmerman's colleagues &
friends who participated in the ses-
sion honoring him: Stuart Taylor, Dan
Inman, Todd Simmermacher, Jose Ma-
ria dos Santos (Zema), George James

Conference attendees enjoyed discussing the latest technologies with IMAC Exhibitors:



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Susan Kay Foss 12/24/41—1/24/13

Susan was born on December 24, 1941 in Traverse City, Michigan to Oskar & Henriette Arnoldt. She attended and graduated

from Traverse City High School in 1959. Subsequent education was at Michigan State University where she earned her Bachelor and Master Degrees in Mathematics. Upon graduation she took a job with the Fairbanks-Morse Corporation in Beloit, Wisconsin where she worked as part of an advanced research and design team. During that time she met a fellow researcher (Chemist) David Foss and on June 18, 1966 they were married at her parent's home in Traverse City, Michigan. Both had strong academic desires to return to school and subsequently moved to Houghton, Michigan to attend Michigan Technological University later that year. They stayed there until 1975 when she received a MS and ABD in Engineering Mechanics. At the same time

David received his PhD in Chemistry. They were both hired by Deere and Company (as the first husband and wife team) and worked in Waterloo, IA for 4 years. In 1980 they transferred to Moline, IL where she continued as a Senior Engineer until her retirement in 2006. During this time, she was also an Adjunct Faculty Instructor at St. Ambrose University.

Susan was affiliated with a number of technical associations and a 40 year member of the Society for Experimental Mechanics (SEM) becoming the first female President of the Society in 1998-99 and Treasurer 1991-94. Within SEM, Susan's most notable accomplishments were the inception and launch of *Experimental Techniques* (ET- a newsletter at the time) with Stu Swartz and a few others in the early 80s. Susan served every capacity there was in relation to ET's growth and evolution into the Applications Journal that it is today. And, by both example and effort, Susan was a mentor to many of the female members of the Society leading the way for others to follow.

She was honored by SEM with the Tatnall, Brewer, and Fellow awards as well as a number of awards from other associations. She published more than 45 articles relating to her technical interests and holds four patents.

David taught Susan the game of golf and she became an avid golfer. In their travels, they visited and played many of the great golf courses of the world. They also enjoyed snowmobiling each winter in Houghton, Michigan.

Throughout her life she and David traveled extensively, but always returned to places that they loved best - Traverse City, MI and Le Claire, IA.

Susan will remain in the hearts of her brother; Roy (Laurea) Arnoldt of Las Cruces, NM; sister-in-law, Joyce Johnson of Roberts, WI; brothers-in-law; Joe (Ruth) Foss of Hudson and Bob (Laurie) Foss of Oakdale, MN; many nieces & nephews; and numerous dear friends.

Remembering Susan Foss by Stu Swartz

One of my first memories of Susan is that of a breakfast meeting at the SESA 1979 Fall Meeting at King's Island, OH. She was promoting *Experimental Techniques* and wanted me to help. She was very persuasive and got me actively involved in the whole ET operation. In those days it was a quarterly "newsletter" of the Applications Committee. The ET meetings were pretty informal and jolly. The venues were poolside, seaside on the beach, or any other desirable location at the SESA conference with various libations available. Usually Susan ran these meetings with efficiency and good humor. The meetings were not closed but also were not publicized, hence only serious advocates of ET were present.

I got to know Susan and David quite well and enjoyed visiting with them. When I was SESA President, it was customary- or so I thought- for the president to supply the wine at the invitation-only President's Reception. Since the meeting was in Cleveland, OH- May 1983- I decided to drive there in my 1971 VW beetle and bring two cases of wine. I stopped overnight at the Foss' in LeClaire, IA; enjoyed dinner with them at Sneaky Pete's; and left the next day for Cleveland accompanied by Susan. She proved to be quite useful in pushing the VW to get it started when the starting motor balked. She loved to tell everyone about this trip and her efforts to get us to Cleveland.

Another memorable trip was to Keystone, CO with Susan and Ken McConnell. They stayed overnight at the Swartz's in Manhattan, KS and we drove the next day on partially snow covered roads in Susan's Audi Quattro. She delighted in demonstrating the car's handling and stability.

One of the major projects on which Susan and I collaborated was creating a new SESA Organization Handbook. Susan did the hard work and I did proof reading and cross-checking. Since then, she did at least one further revision.

These are just a few of my memories of Susan. She always lightened the meetings by her good will, sense of humor, and readiness to help.

2013-14 IMAC Advisory Board Members

Conference Director Alfred L. Wicks



Dr. Wicks received his Ph.D. from Michigan Tech University. Dr. Wicks was a co-founder of Stress Technology Inc and Vibration Analysis Inc. Since joining the

faculty of the Mechanical Engineering Department at Virginia Tech in 1986, Dr. Wicks has developed numerous techniques for applying scanning laser technology to dynamics measurements. He has taught numerous courses on signal processing, instrumentation, modal analysis and vibrations. Current funded research in unmanned systems involves sensing technologies, navigation strategies, and wireless communications

Using his expertise in signal processing and instrumentation, he was the co-leader the DARPA Grand Challenge team in 2004 from Virginia Tech through qualifying to the 5th position in Barstow. During the second Grand Challenge Dr. Wicks was the team leader for Team Rocky placing 9th with at Primm NV. In the Urban Challenge, the Virginia Tech team finished 3rd. He is also served the Technical Chairman of the International Modal Analysis Conference for the last 13 years.

Assisted by Raj K. Singhal



Raj K. Singhal received his BSc in Mechanical Engineering (with Honours) from the Panjab University in India (1970), his MEng in Mechanical Engineering (with

Distinction) from the Indian Institute of Science, Bangalore (1973), and

his Ph.D. in Mechanical Engineering from the University of Saskatchewan, Canada (1986), where his Ph.D. research work was on Vibrational Behaviour of Stators of Electrical Machines. He has published in reputed journals and presented at international conferences numerous papers in these areas: static/dynamic analysis of structures including vibration of membranes, plates, and shells; modal analysis; system identification; experimental vibration and modal analysis; static load testing; mass properties measurements; and photogrammetric/non-contact measurements. Dr. Singhal is coreipient of 2002 Canadian Astronautics and Space Institute's A. J. Saber Award for Best paper on Astronautics or related topics "Force Limited Vibration Testing Applied to the FTS Instrument of SCISAT-1". He held the position of an Adjunct Research Professor in the Department of Mechanical and Aerospace Engineering, Carleton University, Ottawa for the period July 1993 to July 1996. He has been an Adjunct Professor, Department of Mechanical Engineering, University of Ottawa since 1998. He has and still serves as Technical Committee Member and as Session Chair for several international conferences. Currently he is Manager, Structural Qualification Facilities (vibration, shock, modal, static load testing, mass properties, and photogrammetry measurements) at the Canadian Space Agency's David Florida Laboratory (DFL). The DFL is Canada's world-class facility for the assembly, integration, and environmental testing of space and non-aerospace hardware for both national and international companies and organizations.

Future Conference Committee

David J. Ewins



David Ewins has spent the past 50 years studying and measuring vibration in a range of application areas - mostly in aerospace, defence and other hi-

tech industries (including the vibration isolation analysis of an interferometer at NPL in the 1970s). Having studied at Imperial College London and Cambridge University, he has been based at Imperial, throughout his career, and as Professor of Vibration Engineering since 1983, with periods as Visiting Professor overseas in the USA, France, Switzerland and Singapore. Following partial 'retirement' in 2005 (he still spends 1 day per week at Imperial), he now spends most of his time at Bristol University where he is Director of the £20M BLADE (Bristol Laboratory for Advanced Dynamics Engineering) laboratories and Director of the AgustaWestland UTC in Vibration Reduction.

His research has focused on two main areas – Modal Testing (and it applications) and Vibrations in Turbomachinery, in the latter case, working closely with Rolls-Royce since 1963. Current research priorities are (i) developing new test strategies to improve the effectiveness of vibration testing by an order of magnitude, including the development of new laser-based measurement techniques; (ii) properly accounting for the effects that structural joints have on the dynamics of engineering structures and (iii) incorporating robustness characteristics in dynamic analysis and design.

He founded the Dynamic Testing Agency in 1990 (now the Dynamics and

Testing Working Group in NAFEMS), has published a textbook and many papers on Modal Testing, and a total of more than 300 papers on structural dynamics in general. He set up the first Rolls-Royce University Technology Centre (Vibration UTC) at Imperial College on 1990 and is currently setting up the new AgustaWestland UTC in Vibration Reduction at Bristol University. Between these two projects, as the first Temasek Professor in Singapore (at Nanyang Technological University), he set up the Centre for the Mechanics of Microsystems (CMMS) between 1999-2002.

He is a Fellow of the Royal Society and of the Royal Academy of Engineering.

Matthew Allen



Matt Allen joined the faculty of the Engineering Mechanics program in the department of Engineering Physics at the University of Wisconsin-Madison in

2007. He was previously employed as a post-doctoral researcher at Sandia National Laboratories and received Doctoral and M. S. degrees from the Georgia Institute of Technology in 2005 and 2004 and a B.S. in Mechanical Engineering from Brigham Young University in 2001. His current interests include: experimental modal parameter identification/system identification, nonlinear dynamic systems, experimental/analytical substructuring techniques, and just about anything related to structural dynamics. He also enjoys downhill skiing, tennis, mountain biking, Spanish and spending time with his two children.

Chuck Van Karsen



Chuck Van Karsen has been a member of the Michigan Tech Department of Mechanical Engineering – Engineering Mechanics since

August 1987. He is currently Associate Chair and Director of the Undergraduate Program. Prior to that he had a twelve year career as a practicing engineer in the Machine Tool, Automotive, and Software industries. He specializes in Experimental Vibro-Acoustics, NVH, and Structural Dynamics. His research efforts have concentrated on experimental noise and vibration methods related to automotive systems and subsystems, large home appliances, machine tools, and off-highway equipment. Chuck regularly presents seminars and short courses on Experimental Modal Analysis, Digital Signal Processing, Acoustic Measurements and Sound Quality, and Source-Path-Receiver methods. At Michigan Tech, Chuck teaches Mechanical Vibrations, Experimental Vibro-Acoustics, Analytical and Experimental Modal Analysis, Mechanical Engineering Laboratory, and Controls. He received his BSME and MSME degrees from the University of Cincinnati.

Program Planning Committee

Christopher Niezrecki



Christopher Niezrecki is currently a Professor in the Department of Mechanical Engineering at the University of Massachusetts Lowell. He obtained dual B.S.

degrees in mechanical and electrical engineering from the University of Connecticut in 1991. In 1992 he obtained a M.S. degree in mechanical engineering from Virginia Tech and his Ph.D. in 1999 while working at the Center

for Intelligent Materials Systems and Structures (CIMSS). He was the Director of the Smart Structures and Acoustics Laboratory at the University of Florida until 2004, is currently the Co-Director of the Structural Dynamic and Acoustic Systems Laboratory (<http://sdasl.uml.edu/>), and leads the Wind Energy Research Group at UML (www.uml.edu/windenergy). Dr. Niezrecki has been directly involved in smart structures and noise and vibration control research for over 20 years, with more than 75 publications. He is the member of three separate conference executive committees pertaining to structural dynamics/smart structures. Areas of current research include: wind turbine blade dynamics, structural dynamic and acoustic systems, smart structures, controls, signal processing, structural health monitoring, bio-acoustics, and smart materials. Funding for his research (\$5.7M) has been provided by grants from NSF, DOE, ARO, ARL, ONR, AFRL, DOT, U.S. Army Natick Soldier Center, NCIIA, Florida DOT, Motorola, and Florida Fish and Wildlife Conservation Commission, Robert Bosch LLC, Univ. of Florida College of Veterinary Medicine. He is a member of ASME, SPIE, SEM, and the Acoustical Society of America.

Randall J. Allemang



Dr. Randall J. Allemang is a member of the faculty of the Mechanical Engineering Program, School of Dynamic Systems at the University of

Cincinnati, where he currently also serves as Director of the Structural Dynamics Research Laboratory (UC-SDRL). He has been actively involved in the area of experimental modal analysis at the University of Cincinnati, Structural Dynamics Research Lab for over thirty-five years, pioneering the use of multiple input, multiple output estimation of frequency response functions, developing the concept of cyclic averaging, formulating the

modal assurance criterion (MAC), the enhanced frequency response function and reformulating modal parameter estimation algorithms into the unified matrix (coefficient) polynomial approach (UMPA). During this period, Dr. Allemang has authored or co-authored over 140 technical articles, including chapters for 2 different handbooks and numerous refereed articles. Dr. Allemang has participated in over 50 invited seminars or lectures in the United States as well as in Taiwan, Japan, Korea (NSF), India (NSF), Belgium, Germany and France, including being asked to give the keynote address at both the Leuven International Seminar on Modal Analysis (1990) and the 11th International Modal Analysis Conference (1993). Dr. Allemang continues to serve on the IMAC Advisory Board (Chairman, 1986-1995), is serving on the Editorial Board of *Sound and Vibration* magazine, and has served as the Associate Technical Editor for *Mechanical Systems and Signal Processing (MSSP)* and Editor for the *International Journal of Analytical and Experimental Modal Analysis (IJAEMA)*. He currently serves on the International Advisory Board for *Experimental Mechanics*.

Dr. Allemang also served as President for the Society of Experimental Mechanics (SEM), 2003-2004, and on the Executive Board of SEM from 1998-2006. He is very active in teaching in the areas of experimental methods, vibrations and automotive design and serves as Faculty Advisor to a number of student groups at UC including the Formula SAE Team (Bearcat MotorSports), Engineering Tribunal, Tau Beta Pi and Pi Tau Sigma.

James P. DeClerck, Chair



Dr. James De Clerck is a Professor of Practice in the Mechanical Engineering – Engineering Mechanics

Department at Michigan Technological University. He received his Ph.D. in

Engineering Mechanics in 1991. Prior to joining Michigan Tech in 2009, Jim was a Project Design Engineer at the General Motors Noise and Vibration Center in Milford, Michigan. His areas of expertise include noise and vibration, structural dynamics, design, modal analysis, model validation, inverse methods applied to design, and advanced measurement techniques.

Exhibit Planning Committee

Jenn Mowry



Ms. Mowry has worked for Brüel and Kjær for the past 9 years handling all the North American shows, hospitality events and sales meetings. Prior to that she worked for 5 years at *Sound and Vibration* magazine.

Ralph Brillhart



Mr. Brillhart is currently Vice President & Technical Director of Test Projects, with ATA Engineering, Inc. in San Diego, California. He is one of the principals of ATA which started as a spin-off operation from Structural Dynamics Research Corporation (SDRC) in April, 2000. Including his 23 years at SDRC, he has spent almost 35 years conducting and managing test programs in the aerospace, transportation, and entertainment industries. Many of these programs have focused on dynamic and static durability and qualification testing of structures and include modal testing of aircraft, launch vehicles, satellites, and other aerospace hardware. He has become recognized worldwide in his modal testing and analysis expertise and has written numerous papers discussing

the applications of modal testing techniques and new approaches to modal testing. He has conducted many large scale modal surveys of aerospace, automotive, and industrial structures over the past thirty years. Most recently he has served as a member-at-large on the SEM Executive Board.

Mr. Brillhart obtained his Bachelor of Science in Mechanical Engineering at the University of Cincinnati in 1977. In 1983, he obtained his Master of Science in Mechanical Engineering, Dynamics and Controls from the University of California, Davis.

Evro T. Wee Sit



Mr. Wee Sit is the founder and managing editor of SVcommunity.com, a website dedicated to the sound and vibration community. He is

also the founder and president of Sage Technologies which markets sound and vibration instruments. Mr. Wee Sit began his career in 1985 as a test engineer for General Motors specializing in powertrain noise and vibration. He then joined Brüel & Kjær as a field applications engineer and later started an independent engineering consultancy. He is a frequent seminar instructor on the subjects of acoustics, vibration, modal analysis, instrumentation, and signal processing. Mr. Wee Sit holds a B.S.M.E./E.E. from General Motors Institute (now Kettering University). He contributes a perspective from industry based on his engineering and marketing experience.



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Carlos Ventura, SEM President, 2012-2013

And I think that many long-term SEM members could recognize this as part of the experience and knowledge that they have acquired through all these years on attending SEM events and interacting with other colleagues through different SEM activities. However, I think that we can do more about fostering creativity at SEM.

We could encourage the philosophy that no matter what was done in the past, there has to be a better way if innovative projects and the key people who originated the ideas. SEM can also encourage creative and innovative thinking by inviting to our conferences

and meetings individuals noted for their creative and innovative solutions to discuss methods to disseminate how such solutions come about. And we should encourage all our members to attend those sessions. We could also organize forums and discussions to develop a better understanding of the inherent risks of progress and our members should be encouraged to face the risks and gain the benefits.

There is no antagonism between logical or mathematical thinking and creative thinking, and SEM should encourage the synergy between convergent and creative thinking – “doctum ingenium” at SEM.

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profession and increase the efficiency and effectiveness of industry.

What can SEM do to encourage creativity? Creativity and significant innovation must be encouraged, rewarded, and seen to be rewarded. But before potentially useful creative ideas can be generated, considerable effort must be expended to acquire the necessary knowledge. This knowledge is acquired by extensive reading, study of similar situations to find what needs improvement, discussions, and data accumulation from a variety of areas. SEM is, and has been since its beginning, a great source to nurture and promote creative ideas because it is a society that exists to transmit knowledge. So

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