APPLIED MECHANICS DIVISION

Message from the Chair

Tayfun E. Tezduyar

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NEWSLETTER 2011
IOANNIS CHASIOTIS, EDITOR

I joined the AMD Executive Committee on July 1st, 2006. During the past five years, the AMD had an increased level of activity and visibility. With about 5,000 members, the AMD is the largest of the six divisions constituting the Basic Engineering Group of the ASME. It is about 50% larger than the next largest division. Since IMECE 2008, the AMD Program Chair has been managing the IMECE track on **Mechanics of Solids, Structures and Fluids**. I was the track chair at IMECE 2008, and we had over 500 presentations. The track had similar (in fact better) success at IMECE 2009 and 2010, where the track chairs were **Ares Rosakis** (Caltech) and **Ken Liechti** (UT Austin), and from what I can tell, will also do great at IMECE 2011, where the track chair will be **Larry Bergman** (UIUC). At IMECE 2012, the track chair will be **Huajian Gao** (Brown), the newest member of the Executive Committee. Now you know all the Executive Committee members I had the pleasure of working with during the past one year I served as the AMD Chair. I also had the pleasure of working with **Tom Farris** (Rutgers), **Krishnaswamy Ravi-Chandar** (UT Austin), **Dan Inman** (Virginia Tech) and **Zhigang Suo** (Harvard), who were already on the Executive Committee when I joined. I thank all these wonderful friends for their help and support.

Of course the largest portion of the credit for making the track on Mechanics of Solids, Structures and Fluids a great success year after year goes to those who served as topic

(symposium) organizers in the track. We all know that there is a lot of work in putting together a successful symposium, and we are very grateful for the efforts of those topic organizers. At IMECE 2010, as a token of our gratitude, we invited the organizers of the very successful symposia to the AMD Honors and Awards Banquet as the division's guests. This was the first time the AMD did that, and we believe that we started a good tradition, which we expect to continue.

Also for the first time, at IMECE 2010 we invited to the AMD Honors and Awards Banquet the winners of the student travel awards as the division's guests. The students received the **Haythornthwaite Foundation Travel Award** to give presentations in the track on Mechanics of Solids, Structures and Fluids. They were recognized at the banquet. We are very grateful to the Haythornthwaite Foundation for this generous support. The selection was based on the endorsements of the AMD technical committees, and the winners, at the time of their technical presentations, were enrolled full-time in degree programs at US institutions. The travel award winners were also eligible for the **AMD Student Paper Competition**. A committee appointed by the AMD Executive Committee made the selection for the first, second and third place. The winners were, First Place: **Timothy Spielman** (Rice), Second Place: **Aaron Albrecht** (UT Austin), Third Place: **Bradley Henicke** (Rice) and **Aaron Siddens** (Virginia Tech). We are proud of the accomplishments of these outstanding young people who are affiliated with the AMD.

Another part of the AMD that we are all proud of is the **Journal of Applied Mechanics,** which is one of the most successful ASME journals, thanks to the leadership of its current Technical Editor **Robert McMeeking** and the Technical Editors before him and the hard work and high standards of its Associate Editors. Bob is now in the last year of his second five-year term. Following the AMD bylaws, the Executive Committee appointed a search committee chaired by a former Executive Committee chair. The search resulted in the appointment of **Yonggang Huang** (Northwestern University), who will take over as the Technical Editor on July 1st, 2012. We were happy to find as Technical Editor someone with Yonggang's qualifications, and we look forward to the continued success of the Journal of Applied Mechanics.

One of the things that make me most proud of having served on the AMD Executive Committee for five years and chaired the division during past year is that the AMD is home to so many outstanding individuals. That is how it has always been, and I am convinced that that is how it always will be. From among all these outstanding individuals, every year the AMD award committees, through a well-established and rigorous process, select the winners of the six AMD-managed awards. The following outstanding individuals received the **2010 awards** at the AMD Honors and Awards Banquet at IMECE 2010:

- Thomas J.R. Hughes Young Investigator Award: **Harley Johnson** (University of Illinois). For demonstrating creative and interdisciplinary work in modeling the effects of disorder, defects, and deformation in materials for electronics, optoelectronics, and nanophotonics, including quantum dots, carbon nanotubes, ion-irradiated materials, and photonic crystals; and for professional leadership in mechanics of materials.

- Ted Belytschko Applied Mechanics Award: **Yoichiro Matsumoto** (University of Tokyo). For his many, diverse and lasting contributions to the science of applied mechanics through trail-blazing papers on cavitation, bubbly liquids molecular dynamics and biomechanics, through the education and mentoring of younger scientists, and through his visionary leadership.

- Thomas K. Caughey Dynamics Award: **Jerrold Marsden** (Caltech). For fundamental contributions to the dynamical theory of mechanical systems and inspirational work as an educator (award received by family members).

- Daniel C. Drucker Medal: **Rohan Abeyaratne** (MIT). For his seminal work in developing the fundamental ideas of the continuum theory of phase transformations in solids.

- Warner T. Koiter Medal: **Nicolas Triantafyllidis** (Ecole Polytechnique, France). For seminal contributions to the theory and application of stability concepts in the nonlinear response and failure of solids and structures; and for contributions to the international solid mechanics community through various leadership positions.

- Timoshenko Medal: **Wolfgang Knauss** (Caltech). For fundamental contributions to the mechanics of fracture, covering mixed-mode fracture, dynamic fracture, and interface and adhesive fracture, and the characterization of material response and failure at the microscale, with a special emphasis on experimental mechanics.

The following outstanding individuals will receive the **2011 awards** at the AMD Honors and Awards Banquet at IMECE 2011:

- Thomas J.R. Hughes Young Investigator Award: **Ioannis Chasiotis** (University of Illinois) and **Markus Buehler** (MIT).

- Ted Belytschko Applied Mechanics Award: **David Gartling** (Sandia National Lab) and **Ken Chong** (NIST).

- Thomas K. Caughey Dynamics Award: **Philip Holmes** (Princeton).

- Daniel C. Drucker Medal: **John Rudnicki** (Northwestern University).

- Warner T. Koiter Medal: **James Simmonds** (University of Virginia).

- Timoshenko Medal: **Alan Needleman** (University of North Texas and Brown).

Many individuals worked hard during my term as the division chair to make the AMD a success story. **Yuri Bazilevs** (UCSD) has been serving as the Recording Secretary for the AMD Executive Committee and I thank him for the great job he has done. **Ioannis Chasiotis** has been editing this newsletter, and we are grateful for that. **Jacinta McComie** at ASME Headquarters has been providing support to the AMD for many years, taking care of many things related to the AMD, including the AMD Honors and Awards Banquet and brochure the medals. **Stacey Cooper**, also at ASME Headquarters, has been the AMD interface with the IMECE congress organization and Web tools, providing prompt and competent support.

There are many more whom I would like to thank, including the **chairs and members of the AMD technical committees**, and I hope I will be able to do that when I see you at the future ASME meetings.

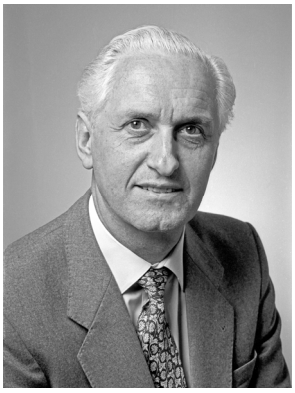
My term as the AMD Chair will end on July 1st, 2011. **Ares Rosakis** (Caltech) will become the new chair that time. Also at that time, **Peter Wriggers** (Leibniz Universitaet Hannover) will replace me as the new member of the Executive Committee. The ASME has become more and more global in recent years, and now the AMD Executive Committee has a member from outside the United States, also for the first time. Best wishes to all.

Tayfun E. Tezduyar, 2010-2011

Chair, Applied Mechanics Division

THE 2010 AMD AWARDS

TIMOSHENKO MEDAL — Wolfgang G. Knauss



The Timoshenko Medal was established in 1957 and is conferred annually in recognition of distinguished contributions to the field of applied mechanics. Instituted by the Applied Mechanics Division, it honors Stephen P. Timoshenko, world renowned authority in the field, and it commemorates his contributions as author and teacher. The 2010 Timoshenko Medal was awarded to Professor Wolfgang G. Knauss, the Theodore von Kármán Professor of Aeronautics and Applied Mechanics at the California Institute of Technology,

for fundamental contributions to the mechanics of fracture, covering mixed-mode fracture, dynamic fracture, and interface and adhesive fracture; and the characterization of material response and failure at the microscale, with an emphasis on experimental mechanics.

The acceptance speech that follows was presented at the Applied Mechanics Dinner of the 2010 ASME International Mechanical Engineering Congress in Vancouver, Canada, on Tuesday, November 16, 2010.

Experimental Mechanics of History

[In the following the italicized portions were stricken from the oral presentation to better approximate the time length suggested. They are retained here primarily for the preservation of historical developments in mechanics.]

It is a great honor to be selected to address you tonight on the occasion of receiving the Timoshenko Medal, the award notification of which caught me by total surprise. Selections for such honors are sometimes difficult and possibly contentious processes, and I thank the 15 or so colleagues making up the various committee groups for their forbearance and benevolence towards me. I am proud of this award, because it makes me only the fourth Caltech faculty recipient, with Theodore von Karman, Eli Sternberg and Anatol Roshko the forerunners, and with two of these being heavily devoted to experimental work. I belong to a generation that no longer has a personal connection to Stepan Prokofievich Timoshenko, nor do I possess an academic genealogy which connects me to him, other than the assiduous studies of his "black books" as other Timoshenko awardees have called them. Instead, my history links me, in direct sequence, to Max

Williams, Ernie Sechler, Theodore von Karman, Ludwig Prandtl, August Föppel and Christian Otto Mohr, of Mohr's circle fame: I owe a lot to these, my academic "forefathers".

One of the intended purposes of the addresses following the Timoshenko award dinners is, if somewhat loosely, to preserve a history of (applied) mechanics. The choice of my title implies the reverse, namely that mechanics can and does describe or control history. That is indeed true if one thinks of the structural systems that contain viscoelastic materials which require the tracking of the deformation or loading histories to describe the system response. This may be a superficial twist of words, but the realistic implications are severe, as, I hope, you will see.

I owe personal and professional thanks to numerous individuals, and I cannot, with a clear conscience speak here without acknowledging and thanking them, and to let them participate in this honor. I will, therefore, divide the talk into two parts:

a) a brief recognition of at least two benefactors who got me to this podium followed by

b) the recounting of some mechanics-historical aspects, interlaced with remembering those who were involved in their developments. I do this primarily so that I can acknowledge the important role which my over 60 students and post docs played in my career and who have helped me over the years; I hope they will understand that there is not enough time allotted to mention them all here.

As the youngest in a German Methodist pastor's family with two brothers, my childhood was dominated by World War II, especially through the frightening air raids which leveled the small industrial town (Siegen) 60 miles east of Cologne where we lived then. After five years of reconstruction, my father was transferred to Heidelberg, so that my oldest brother could attend the University. Heidelberg -virtually untouched by war destruction- was a major tourist attraction for Americans. Among the visitors was a minister, Dr. Frank Williams, who at that time was the pastor at the Methodist Church closest to Caltech. When my father died during my final High School exams (Abitur), an advanced education was suddenly thrown into jeopardy. At that moment Frank Williams and his wife Margaret invited me to live with their family near Pasadena so I could attend college in the US. I lived with them for four years until I graduated with a BS in 1958 and married my wife Lydia, whom I had asked to come from Germany. Such magnanimity and generosity has shaped my experience and view of the United States to this day. While attending Pasadena City College, Dr. Williams suggested that I try the transfer examination to enter Caltech as a sophomore, -my English, while good, was not sufficient to allow me to enter Caltech as a freshman- because, besides it being a good college, "that would greatly simplify the logistics to get me to and from school". I have been there ever since 1955.

Another Dr. Williams had a dominant influence on my career. Although I was interested initially in studying Jet Propulsion, Max L. Williams —Professor of Aeronautics at GALCIT and no relation to Pastor Frank S. Williams— offered me a summer job after the BS, which introduced me to solid mechanics, and more specifically, to fracture mechanics. Moreover, Max Williams's continual desire to combine theoretical endeavors with experimental evidence influenced my entire career by taking preponderance in virtually all

of my studies. Besides bending my interest into solid mechanics, Max Williams provided for other professional starts for me: He had gotten me appointed at Caltech as an assistant professor, and when he moved to the University of Utah as dean of engineering in 1966 he did another unbelievably good deed for me: He left me a lucrative NASA grant —in today's value close to 3/4 million dollars, not counting the follow-ons— with which I could perform all my early research on crack propagation in viscoelastic materials.

Let me move to part b).

In the late 1950s linearly viscoelastic theory and analysis in engineering revolved around the use of differential operators, and how Laplace or Fourier transforms reduced viscoelastic problems into elastic analogs through the correspondence principle. This type of formulation has today largely given way to the integral formulation for the constitutive laws, primarily coupled with computational means.

Before my graduate years chemical physicists were concerned primarily with studying the molecular structure and molecule interactions with little or at best secondary relation to structural problems. The major exception turned out to be the time-temperature trade-off principle, which started with Ferry (1950) and Tobolski (1952) and culminated in the phenomenally successful story of the Williams-Landel-Ferry (WLF, 1955) equation (and concept), which is still a major player in viscoelasticity today.

In 1957 Sputnik signaled a new era in aero-space developments including the need for a better understanding of the mechanical behavior of solid propellant rocket fuels. It now turned out that the chemists and chemical engineers, who formulated the compounds, lacked the understanding of how to incorporate their mixtures structurally and safely into a relatively rigid rocket motor case under sustained gravity and high acceleration loads. This new hardware required viscoelastic stress analysis which brought forth a number of capable, primarily academic, leaders: Max. L Williams dominated the field of physical properties and fracture, Erastus H. Lee originated the correspondence principle –he was another Timoshenko medalist– and who was versed in the non-isothermal behavior; he and Harry Hilton addressed static and vibration analyses, while Karl Pister, Eric Becker and Charlie Parr, the latter of Rohm & Haas, were instrumental in developing and exploiting the new and growing field of (elastic) finite elements.

Early issues dealt with motor slump associated with the possible gas flow restriction in the central bore resulting from long time storage or acceleration during lift-off; this problem precipitated my first experiment presented at a national meeting: To demonstrate the shape of a deformed, cylindrically perforated motor under axial acceleration, I cast grain shapes of Lemon-flavored Jell-O into a Plexiglas cylinder casing with a similarly clear bottom, from which a central, hollow brass mandrel could be removed after heating it with hot water. The deformations were literally very clear, but the most memorable comments I received for this were, that, whether the "experiment failed or succeeded, it could at least serve as desert on the dinner table of a graduate student living on a low stipend".

Solid propellant fuels are mostly "highly loaded" particulate composites: Ammonium perchlorate (*oxygen supply,* 80 to 90% by weight) is bonded together with a rubbery binder along with various additives such as aluminum powder for burning rate control. Not a simple homogeneous solid! A continual problem was that deformations could be accompanied by the binder pulling away from the particles, a process called "dewetting", and associated softening. While this was being recognized, exploited notably by Rick Farris, later professor at the University of Massachusetts, it dominated the nonlinear character of these materials and impeded progress, because any nonlinear analysis was difficult in those days (the computers were used in the infancy of FE stress analysis). Dick Schapery derived his "nonlinearly viscoelastic" model on the basis of this behavior, and later Cate Brinson addressed the thermorheologically complex behavior of composites containing multiple viscoelastic phases.

A dominant issue concerned, however, fracture and grain cracking in the motor star valleys: To provide a nearly constant burning surface, the longitudinal perforation of a motor had the cross section of a typically five-point star. Under thermal shrinkage and/or pressurization upon ignition there existed thus the proclivity for cracks to form and propagate at the stress concentrations in the star valleys.

In place of the real but complex propellant I chose to model fracture with a homogenous polyurethane elastomer. Although the experimental equipment required was rather simple, the demonstration of repeatable and non-age related phenomena were important. I had the good fortune to have my first and capable graduate student, Hans-Karl Müller, work with me. To our surprise the data of crack speed was treatable by the time-temperature superpositioning principle usually associated with small deformation behavior, even though the strains at the crack tip were huge. From this followed the first theoretical, mechanics-based treatment of crack propagation in (linearly) viscoelastic materials (1971), succeeded by a more refined treatment of the cohesive forces at the crack tip (1973,1974) which was followed by Dick Schapery's power law-approximation (1975).

This development led to knowledge-transfer to the adhesion community for time-dependent disbonding, work that was carried on by Ken Liechti, who has had a very significant influence on fostering the use of mechanics in the community of chemists and physicists who then dominated adhesion research. In this discipline I was also fortunate to have G. Ravichandran (Caltech-Ravi) and later Philippe Geubelle provided analytical support to the adhesion community, along with John Bowen's experimental work.

It has always been a hope of mine that at least the rudiments of viscoelastic behavior be taught in virtually every undergraduate program. But that does not seem to have happened, even though by the mid 80s the **weight** of polymers produced in the US had surpassed that of steel. Thus a tremendous shift or change in the use of many materials in engineering occurred. The consequences of engineers not being properly informed on the time dependent issues are understandable in the early days but did and will have serious consequences. Though there are numerous and expensive examples, let me document here only two:

In the 1970s someone had the bright idea to simplify the delivery of drinking water, both through under-street as well as via in-home hot and coldwater plumbing. Compared to steel pipe (and even copper) the low weight and ease of assembly via gluing polymer tubing was very appealing and "cost-efficient". This type of system was so "efficient" that large portions were, at times, assembled in a shop and then transported to the site for installation. The system consisted of polybutylene tubing and angle fittings of Celcon, an acetal copolymer, which were joined to the tubing via mechanical (compression) crimping employing copper rings. The underlying engineering consisted of testing the system under pressure for a few days to demonstrate, that all was well. However, there were a number of problems with these systems many of which traced back to the time-dependent properties of the materials making up the system. Here is one example of where even minimal exposure to time-dependent material behavior in a school curriculum would have been helpful: While enough support points for the tubing were recommended to hold the water-filled tubing in place, no one had, apparently, worried about specifying that this support should be arranged along the tubing so as to prevent any significant bending moments from being transmitted to the fittings. One result was that after a number of years the fittings under bending could develop cracks and flooded a home, a consequence that is obvious to any one who deals with polymers in engineering applications. The only answer to this poor design was re-plumbing the houses completely. Also, virtually all in-street water distribution in Puerto Rico was of this type, obviously not necessitating any other support than laying the pipes in a trench, but this happened without special care regarding bending moments. This application required vast and costly replacements. Another detrimental aspect was that both the Polybutylene tubing and the Celcon fittings were susceptible to attack by the trace amounts of chlorine in drinking water, which helped erode the wall thickness of the tubing and the fittings with time, and thus accelerated the failure process, sometimes even to the point where tubing split before the fittings failed. A costly affair!

Another example of missing educational exposure to the time-temperature sensitivity of polymer response was at the root of the Challenger explosion (1986). The launch took place after several days' delay and during a cold spell, with temperatures outside of the recommended launch envelope. Though Thiokol-Morton engineers were well aware of the fact that temperature had a strong effect on the response times of the sealant rubber in the boosters and advised against launch, they were overruled. Ultimately, this turned out to be the immediate (engineering) cause for the failure. As the story goes, Dick Feynman had a lot to do with steering the investigative Rogers commission in that direction.

There is an interesting vignette to this commission for me: The thought had leaked out that the seal may have been involved in the failure. Normally, an aeronautical engineer is not prone to educate a theoretical physicist of the Dick Feynman stature. But, he being a Caltech colleague of mine, it seemed rational to talk to him. Besides, his daughter and our youngest son Stefan, who is in the audience here tonight, played in the Pasadena Young Musician's Orchestra, which orchestra my wife guided/chaperoned on tour through Germany in 1981. Dick also had been to our home repeatedly to arrange chairs for the annual garden festivities on behalf of that orchestra. So, when I called his office he had just left for Washington, which was not much of a problem, because I was going there the next

day. I reached him there at the Holiday Inn and told him what my purpose of calling was. I explained how temperature had an effect on changing the time scale of viscoelastic solids (rubber) so that their response time would be lengthened if the temperature got too low. I pointed out to him that if cold rubber is released from a prior constraint (stretched rubber band in a freezer), it will retract, but slowly so. He listened, and after about 15 minutes of discussion he said: "Hey, you really do want to help me!?" Apparently he had heard from enough cranks. While I cannot claim that I was the one responsible for Dick Feynman's education on the Time-Temperature Superposition Principle, I do feel that I at least sensitized him to its importance. He later demonstrated it in the commission meeting by dunking the sealing O-ring rubber in ice water.

A significant detour from strictly viscoelastic fracture studies came about when the problems in solid rockets received diminished funding. Because of my continuing interest in fracture mechanics –after all, I was a Max Williams student– it had always bothered me that the unresolved issues in dynamic fracture, namely crack branching and fragmentation, were investigated with specimens the sizes of which were too small to rule out multiple wave interactions between the crack tip and the boundaries. At that time the analysis of wave propagation in finite geometries was either very limited or non-existent. Several of the previous Timoshenko medalists talked of scientific epiphanies in their careers and I think this one qualifies: My colleague Chuck Babcock was a consultant to the McDonald Douglas Company. He told me of a set of nifty experiments there, involving an electro-magnetic Lorentz force generator to rapidly exert pressure to shell rings. That is when it struck me: What if one were to insert the conducting strip of such a device into the crack in a large plate so that during the time of interest no reflected waves would get back to the crack tip; this would be the ideal experimental geometry to parallel the dynamic crack analyses which did exist for infinite domains. A further fortunate ingredient was that Cliff Astill at NSF hinted that he was looking for supporting experimental work, and the final stroke of luck was the arrival of capable students, first Gordon Smith, then Ravi (K. Ravi-Chandar, aka. Austin-Ravi) and then Pete Washabaugh. We were able to demonstrate why the predictions of the linearized theory of elastodynamics, namely that the crack speed should reach the Rayleigh wave speed, did not materialize: Said simply, the linearized elasticity theory applied to materials possessing vanishing cohesive forces, but that situation is hardly matched in the real world.

Issues not resolved by this fracture work concerned the role of in the nonlinear viscoelasticity crack propagation in rigid plastics, where yield-like phenomena are important. As a consequence one could not readily formulate extensions of the linearized theory to behavior of the more common engineering plastics, as nonlinear (plastic) fracture mechanics had been extended from the Griffith concept. The nonlinearly viscoelastic constitutive theory paralleling plasticity simply did not exist, and still does not, today. This recognition precipitated a continuing study of the role of dilatation and how that affects the viscoelastic time scale of a material. Consequently, work needed to be initiated that centered on the effect of time-dependent volume or bulk response on non-linear behavior. By then, no one had attempted to experimentally characterize viscoelastic bulk behavior for over thirty years because it was difficult, and, besides, the earlier work was performed on a material that is a primary ingredient in chewing gum. Tony Deng and Sandeep Sane

performed painstaking work in carrying that work through, and Hongbin Lu and Weidong Zhu provided the experimental follow-on with respect to the role that this behavior has on the nonlinear response of rigid polymers (plastics), while Igor Emri and Giancarlo Losi provided the ground braking numerical analyses. Problems associated with this question still exist today and form major stumbling blocks to advancing the understanding of failure mechanics under high rate deformation and explosive loading conditions on elastomers, presently of concern to Roshdy Barsoum of ONR.

A topic of great interest to NASA's structures program pursued by its very influential manager of the structures division, Jim Starnes, was that of structural stability, and for me that meant time-dependent buckling. At the time Tim Minahen came to me as a student there was only the estimate of a time dependent buckling load by substituting the elastic Yong's modulus by its viscoelastic (relaxation) counterpart. Experiments quickly showed that that was not a reliable approach, and Tim's work demonstrated that while a counterpart of the Euler treatment did not want to materialize, an initial imperfection approach made experiments and theory coalesce very well.

A final area of experimental work, initially motivated by polymer composites, centered on the smallest size scales. In mechanics it looked like microscopic domain work came of interest in the late 70's, so it seemed wise to get started. But agencies are not prone to let go of their money, unless there are enough people singing the same tune. At that time the digital image correlation method was under development and it seemed like combining submicroscopic imaging with solids deformation would be a wonderful tool to shed light on phenomena occurring at the smallest scale in composites. Although the tunneling electron microscope had been invented there were no instruments available (1981) with which one could interrogate a sample mechanically and deform it while on the microscope. This simply meant, that a mechanician had to build his/her own microscope. To achieve that goal it took us about 6 years to get, in 1986, $30,000 from NSF with the help of Lallit Anand. This just defrayed the cost of the hardware parts and construction, which Guillaume Vendroux did with excellent results. I still recall the wonder of the "first light" (first scan) experience. But before the great onslaught of "micro- and nano-mechanics" there was little interest in pursuing that work. The ultimate benefit accrued to my second-to-last graduate student Ioannis Chasiotis, who used our lab experience over the previous 15 years for his Ph.D. work.

Another illustration where being too early with experimental endeavors, was related to biomechanics. In the mid 70s Nick Panagiatopulos of JPL made me become interested in the mechanics of the human body and we developed a program directed at the viscoelastic behavior of the human intervertebral disc. Very few people worked in biomechanics at that time, but it seemed to be a promising field until one discovered that there were no jobs for the graduates in that discipline. After I found out from the celebrated biomechanician Y.C. (Bert) Fung –another Timoshenko medalist who was at UCSD by that time-, that this was also a continuing problem for him, I decided to shut down that effort: It seemed unfair to get a student all hopped up about an exciting field and then find him relegated to pumping gas. What a difference two decades made in this regard. An outcrop during that early biomechanics study was, that with two masters class student we examined the mechanics of

radial keratotomy (near-sightedness correction via radial cuts in the cornea). Ophthalmology researchers at USC, concerned with the durability of the operation, did not wish to believe the then (Fyodorov's) prevailing theory that the cutting process disturbed an invisible tensile ligament around the eye's iris to lower the cornea's curvature. Through building a 15x scale and suitably pressurized rubber model and applying simple dimensional analysis to the results we could show that the keratotomy process was fully explained by the fact that the cutting merely changed the over-all compliance of the cornea under the influence of the intraocular pressure. Though ophthalmologists at large, not versed in mechanics, were rather skeptical, the USC colleagues confirmed these results successfully in their studies with Rabbits' eyes and used them until radial keratotomy was eventually replaced by various forms of the current laser treatments.

I need to come to a close. Let me again thank all those who have helped for this event to materialize for me, notably all my students and post docs, from whom I learned a lot, whether they were mentioned explicitly and are here tonight or not. Finally, I owe much to my wife Lydia and my sons Friedrich and Stefan for years of support and patience. Thank you all.

Wolfgang G. Knauss
2010 Timoshenko Medalist

Timoshenko Medalist Wolfgang Knauss (left) with AMD Chair Tayfun Tezduyar (right).

DANIEL C. DRUCKER MEDAL: Rohan Abeyaratne

The Daniel C. Drucker Medal was established in 1997 and is conferred in recognition of distinguished contributions to the field of applied mechanics and mechanical engineering through research, teaching and service to the community over a substantial period of time. Instituted by the Applied Mechanics Division, the medal honors Dr. Daniel Drucker and commemorates his service to the profession.

The 2010 Daniel C. Drucker Medal was conferred to Professor Rohan Abeyaratne, the SMART Director & Quentin Berg Professor of Mechanics Department of Mechanical Engineering Massachusetts Institute of Technology,

for his seminal work in developing the fundamental ideas of the continuum theory of phase transformations in solids.

Drucker Medalist Rohan Abeyaratne (left) with AMD Chair Tayfun Tezduyar (right).

WARNER T. KOITER MEDAL — Nicolas Triantafyllidis

The Warner T. Koiter Medal, established in 1996, is bestowed in recognition of distinguished contributions to the field of solid mechanics with special emphasis on the effective blending of theoretical and applied elements of the discipline, and on a high degree of leadership in the international solid mechanics community. The award was funded by the Technical University of Delft, The Netherlands, to honor Warner T. Koiter for his fundamental work in nonlinear stability of structures in the most general sense, for his diligence in the effective application of these theories, his international leadership in mechanics, and his effectiveness as a teacher and researcher.

The 2010 Warner T. Koiter Medal was conferred to Professor Nicolas Triantafyllidis, Professor of the École Polytechnique, and Director of Research at the Solid Mechanics Laboratory Palaiseau France,

for seminal contributions to the theory and application of stability concepts in the nonlinear response and failure of solids and structures; and for contributions to the international solid mechanics community through various leadership positions.

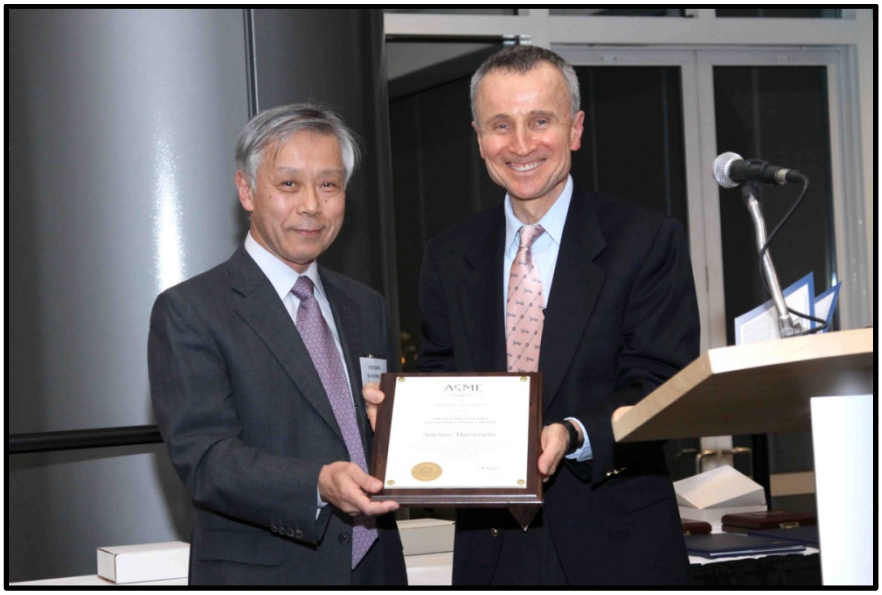
Koiter Medalist Nicolas Triantafyllidis (left) with AMD Chair Tayfun Tezduyar (right).

TED BELYTSCHKO APPLIED MECHANICS AWARD — Yoichiro Matsumoto

The Ted Belytschko Applied Mechanics Award is bestowed to an outstanding individual for significant contributions in the practice of engineering mechanics. The contributions of this individual may result from innovation, research, design, leadership or education.

The 2010 Ted Belytschko Applied Mechanics Award was conferred to Professor Yoichiro Matsumoto, Professor of Mechanical Engineering Department of Mechanical Engineering at the University of Tokyo,

for his many, diverse and lasting contributions to the science of applied mechanics through trail-blazing papers on cavitation, bubbly liquids molecular dynamics and biomechanics, through the education and mentoring of younger scientists, and through his visionary leadership.



Recipient of the Ted Belytschko Applied Mechanics Award, Yoichiro Matsumoto, (left) with AMD Chair Tayfun Tezduyar (right).

THOMAS J.R. HUGHES YOUNG INVESTIGATOR AWARD — Harley T. Johnson

The Thomas J.R. Hughes Young Investigator Award recognizes special achievement for young investigators in Applied Mechanics. The nominees must not have reached their 40th birthday at the time of nomination.

The 2010 Thomas J.R. Hughes Young Investigator Award was conferred to Associate Professor and Cannon Faculty Scholar Harley T. Johnson, from the Department of Mechanical Science and Engineering at the University of Illinois at Urbana-Champaign,

for demonstrating creative and interdisciplinary work in modeling the effects of disorder, defects, and deformation in materials for electronics, optoelectronics, and nanophotonics, including quantum dots, carbon nanotubes, ion-irradiated materials, and photonic crystals; and for professional leadership in mechanics of materials.

Recipient of the Thomas J.R. Hughes Young Investigator Award, Harley Johnson, (left) with AMD Chair Tayfun Tezduyar (right).

THOMAS K. CAUGHEY DYNAMICS AWARD — Jerrold E. Marsden

The Thomas K. Caughey Dynamics Award is established in 2008 and is conferred in recognition of an individual who has made significant contributions to the field of nonlinear dynamics through practice, research, teaching and/or outstanding leadership.

The 2010 Thomas K. Caughey Dynamics Awardee was Professor Jerrold E. Marsden, the Carl F. Braun Professor of Engineering, Department of Computing and Mathematical Sciences at the California Institute of Technology,

for his *fundamental contributions to the dynamical theory of mechanical systems and inspirational work as an educator.*

The Thomas K. Caughey Dynamics Award is conferred to a family member of Jerrold Marsden (left) by the AMD Chair Tayfun Tezduyar (right).

JOURNAL OF APPLIED MECHANICS

The Journal of Applied Mechanics, edited by Bob McMeeking, is once more the leading comprehensive publication in the area of applied mechanics, with articles in all relevant areas, including solid mechanics, dynamics and fluid mechanics. JAM now publishes special issues in topical areas, and it encourages researchers in applied mechanics to come forward with proposals for such editions. The Journal's team of Associate Editors has worked hard to improve the handling of papers, to ensure that JAM attracts the best papers in the field. Thus the Journal of Applied Mechanics is an excellent vehicle for your manuscripts, and we ask you to encourage your colleagues and students to submit their best work to the Journal.

Bob McMeeking, Editor
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IMECE TRACK ON MECHANICS OF SOLIDS, STRUCTURES AND FLUIDS WAS A BIG SUCCESS AT IMECE 2010

Track 12 **Mechanics of Solids, Structures and Fluids** of the ASME IMECE 2010 in Vancouver, BC was again the focus of Mechanics related topics. On behalf of the AMD Executive Committee, I would like to thank the AMD Technical Committees and affiliated ASME groups and their Symposia Chairs and Co-Chairs for their hard work in putting on a successful event. In the end, there were about 600 papers spread over 40 symposia. Track 12 started with a plenary session featuring presentations by Rohan Abeyaratne, Quentin Berg Professor of Mechanics at MIT and CEO & Director of the SMART Centre of the Singapore MIT Alliance for Research and Technology and Yoichiro Matsumoto, Professor of Mechanical Engineering at the University of Tokyo. As it turned out, both were being honored by awards with the Drucker Medal going to Abeyaratne and the Ted Belytschko Applied Mechanics Award falling to Matsumoto. Abeyaratne talked about "Some Basic Questions Concerning Multiscale Analysis" while Matsumoto presented a paper "Toward the Multi-scale Simulation for a Human Body Using the Next-Generation Supercomputer." Other highlights of the Track included a Symposium honoring the Drucker Medallist and the presentation by the Koiter Medallist, Nick Triantafyllidis. Of three poster sessions that were held, one was entirely dedicated to AMD presentations. Now we can look forward to another successful IMECE in November 2011, under the able guidance of the new Track 12 Chair, Larry Bergman.

Kenneth Liechti, Chair

Chair of Track 12: Mechanics of Solids, Structures and Fluids

AMD-DRIVEN CONFERENCE TRACK ON MECHANICS OF SOLIDS, STRUCTURES AND FLUIDS IS EXPECTED TO BE AGAIN A BIG SUCCESS AT IMECE 2011

IMECE 2011 will take place at the Hyatt Regency Denver and Colorado Convention Center during November 11-17, 2011 (http://www.asmeconferences.org/congress2011/). The Track-Topic system is employed again this year, with Track 12: Mechanics of Solids, Structures and Fluids being the main track for symposia organized by the Technical Committees of the Applied Mechanics Division of ASME. Thanks go to all Technical Committee chairs, co-chairs and members who helped in the organization process by proposing, seeking papers for and populating symposia/sessions with interesting presentations. At the time of writing, we have approximately 450 presentations in 36 Topics.

Track 12 will begin with a plenary session on Monday morning featuring presentations by John Rudnicki, David Gartling and Ken Chong. All three are awardees this year, with the Drucker Medal going to Rudnicki and the Ted Belytschko Applied Mechanics Award shared by Gartling and Chong. Rudnicki's presentation is titled "Formation and Extension of Localized Compaction in Porous Sandstones," Gartling will present "A Finite Element Method for Ablation Problems," and Chong will present "Nuclear Energy: Safety, Production, Mechanics Research and Challenges." Additional highlights include a Symposium honoring the Drucker Medallist, organized by Yonggang Huang, and the presentation by the Koiter Medallist, James Simmonds, titled "The Simple Logic of Classical Nonlinear Thermodynamic Shell Theory." Symposia and sessions in Track 12 are again expected to continue through Thursday, so please plan accordingly.

The AMD Student Travel Award program for students enrolled in US universities will continue this year. To encourage more participation by the Technical Committees in the process, the TCs were invited to nominate students for the travel awards based on the applicant's CV, abstract and a draft presentation. Between ten and fifteen travel awards will be made, and those students will then be eligible for the AMD Student Paper Awards, which will be judged based on the final presentation. The students will again be presenting their papers in sessions sponsored by their TCs rather than all being grouped in a student paper session. As a result, the final electronic version of each presentation will be evaluated by the Executive Committee after the actual presentation.

This year, NSF is sponsoring a Student Poster Symposium at the IMECE, open to undergraduate and graduate students working on projects relevant to one or more technical disciplines of IMECE 2011. Interested students can submit an application to receive a travel award to participate in this Symposium. A total of 40 student awardees will be selected from the applicant pool by a review committee, with each awardee receiving $950 to partially defray the cost of attending the conference. Those students will present their research at the NSF-Sponsored Student Poster Symposium. Questions and comments regarding the Symposium should be addressed to Professor Emmanuelle Reynaud, Department of Mechanical Engineering, University of Massachusetts Lowell.

On behalf of the AMD Executive Committee, I would like to once again thank all those who organized symposia for IMECE 2011 for their efforts, and all authors for their

contributions. Please plan to join us in Denver for what promises to be a successful and stimulating conference.

Larry Bergman, Chair
Track 12: Mechanics of Solids, Structures and Fluids, IMECE 2011

Applied Mechanics and Materials Conference: McMAT-2011

The Applied Mechanics and Materials Conference, McMAT-2011 was held at the Fairmont Hotel Chicago, May 30 to June 1, 2011, under the combined auspices of the Applied Mechanics and Materials Divisions of the ASME. Technical Program of the conference comprised twenty-two symposia spread over eleven parallel sessions during the three days of the conference. Over five hundred papers were submitted from which around 480 papers were accepted and scheduled for presentation.

The conference contained three plenary lectures – by Robert M. McMeeking, L. Ben Freund and Peter Wriggers. Invited talks and technical presentations were made by leading experts from academia and industry. The majority of the speakers were from the United States. In addition there was participation from over thirty countries from Europe, South America and Asia.

The website of McMAT-2011 is: **https://www.asmeconferences.org/McMat2011**

Arif Masud

General Chair McMAT-2011
University of Illinois at Urbana-Champaign

NEWS FROM THE TECHNICAL COMMITTEES

The reports that follow are from the Chairs of the Technical Committees of the Division of Applied Mechanics. If you are interested in the activities of a particular committee, please feel free to contact the Chair.

Mechanics in Biology and Medicine Committee

Chair: Philip LeDuc
Vice-Chair: Sulin Zhang
Members: (listed alphabetically) Gang Bao, Markus Buehler, Frank Del Rio, Yuris Dzenis, Hai-Chao Han, Jimmy Hsia, George Lykotralitis, Robert McMeeking, Glaucio Paulino, Kathy Puskar, Taher Saif, Alok Sutradhar, Vikas Tomar, Wei Tong, Kai-Tak Wan, Yaling Liu, Franck Vernerey.

The Technical Committee on Mechanics of Biology and Medicine in the Applied Mechanics Division of ASME has been continuing to work together in a myriad of ways. Before giving more details on these below though, I would like to introduce Sulin Zhang who is now the vice-chair of this committee and will become the new Chair at IMECE in Denver in November 2011. I have enjoyed my term as the chair and hope that I have done a good job for everyone. Sulin will do a wonderful job being the chair of the committee. He has been very active with it and personally has a very good nature.

The Technical Committee (TC) on Mechanics of Biology and Medicine continues to work hard and build momentum through organizing sessions at national and international conferences. For example, we organized sessions for the 2010 ASME International Mechanical Engineering Congress & Exposition. We also are currently organizing sessions for the 2011 ASME International Mechanical Engineering Congress & Exposition, ASME Applied Mechanics and Materials Conference, McMAT-2011, 48th Annual Technical Meeting of the Society of Engineering Science, and the 23rd International Congress of Theoretical and Applied Mechanics (ICTAM2012).

Over this past year, our TC organized a topic area in Intracellular/Molecular Biomechanics and Cell Mechanics with sessions at the 2010 ASME International Mechanical Engineering Congress & Exposition (November 12-18, 2010 in Vancouver, British Columbia, Canada) in the Mechanics of Solids, Structures and Fluids track. Philip LeDuc was the lead organizer with co-organizers Gang Bao, Jimmy Hsia, Kathleen Puskar, JN Reddy, Taher Saif, and Sulin Zhang. A special presentation was given by a Program Director of the National Cancer Institute of the NIH on their current efforts involving the application of mechanics in cancer research with special attention to the newly created and funded Physical Sciences-based Oncology Centers. We also met together as a committee during the 2010 ASME IMECE to develop a plan for future activities.

Currently this TC is organizing a topic with sessions at the ASME Applied Mechanics and Materials Conference, McMAT-2011 (Chicago, May 30-June 1, 2011). These will be in the areas of Tissue Mechanics, Cell Mechanics, Molecular Biomechanics, Mechanics of Biomaterials, Novel Technologies in Biomechanics, and Computational Modeling in

Biomechanics. Alok Sutradhar is the lead organizer with co-organizers Gang Bao, Markus Buehler, Nastaran Kuhn, Taher Saif, Philip LeDuc, and Sulin Zhang.

Also, this TC is organizing a topic with sessions at the upcoming 2011 ASME International Mechanical Engineering Congress & Exposition (November 11-17, 2011 in Denver, Colorado) in the Mechanics of Solids, Structures and Fluids track. These will be in the areas of Tissue Mechanics, Cell Mechanics, Molecular Biomechanics, Mechanics of Biomaterials, and Novel Technologies in Biomechanics. Sulin Zhang is the lead organizer with co-organizers Gang Bao, Jimmy Hsia, Markus Buehler, Philip LeDuc, and Taher Saif.
In addition, Jimmy Hsia and Taher Saif are organizing symposia for the 48th Annual Technical Meeting of the Society of Engineering Science (Northwestern University, October 12-14, 2011).

Furthermore, Gang Bao is organizing sessions at the 23rd International Congress of Theoretical and Applied Mechanics (ICTAM2012), which will be held in Beijing, China (August 19-24, 2012). He will be the co-chair for a Pre-Nominated Session (PNS) in Biomechanics and Biomaterials in the Solid Mechanics area.

We welcome members of the applied mechanics community to participate in the activities of the Mechanics in Biology and Medicine Technical Committee as well as providing suggestions and help. Thank you.

Philip LeDuc, Chair
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Sulin Zhang, Vice-Chair
suz10@psu.edu

Composite Materials Committee

Chair: Massimo Ruzzene, Georgia Institute of Technology (GA Tech)

Vice Chair: Hassan Mahfuz, Florida Atlantic University.

The meeting was held at Room 14, Convention Center East, between 1:00 – 2:00 PM on Tuesday, November 16, 2010. The meeting was called in order by the Chair at 1:00 PM. The following persons were in attendance at the meeting:

Massimo Ruzzene, Hassan Mahfuz, Ioannis Chasiotis, Mrinal Saha, Shaik Zainuddin, Nazmul Islam, Gary Seidel, David Miller, Naveen Rastogi, Peter Gustafson, Sue Mantell, George Kardomateas, Leila Ladani, Catherine Phan, Xin-Lin Gao, Emanuael Ayorinde.

A list of symposia organized in 2010 by the AMD Composite Committee was distributed among the attendees. The list is shown as an attachment at the end of this report. A total of ***12*** symposia were organized and ***124*** papers were presented. Out of 12 symposia, two were co-organized with the Materials Division (MD, Track 15), and one with Track 2 (Biomedical and Biotechnology Engineering). Number of papers presented was no doubt

very impressive. The chair sincerely appreciated the effort made by the topic organizers and co-organizers in putting together this large number of papers related to state of the art research in the area of composites. Most of the papers were for technical presentation only and a few were published in the CD proceeding as technical publication.

As in previous years, several concerns were raised in the meeting regarding the organization of Tracks and Papers. It was noticed that papers were being cancelled by ASME without informing Track Chairs, Committee Chairs, and Session Organizers. In one instance, a paper from Europe was switched to a different session from the original one and the author decided not to attend and present the paper. Session organizer and the author did not have any prior knowledge of the switch. It was discussed that if such changes are to happen, it should be done in a proper way by informing the session organizers and authors ahead of time.

The topic of "Technical Presentation Only' and "Technical Publication" again came this as it did in 2009. The general consensus was that this committee particularly encourages "Technical Presentation Only" since publication in a CD proceeding is basically of very little significance. However, the option for "Technical Publication" was also kept open, especially for younger faculty members to facilitate the later submission to a special issue of a related journal after modifications. Submission of a full paper may sometimes be viewed as a career enhancement tool for young professionals both in academia and in industries. The attendees mostly encouraged technical presentations but agreed to maintain the status quo.

Another issue was discussed that in the technical program either on the ASME web site or in the hard copy, not all sessions were marked by organizer, co-organizer, or session chairs – some of the sessions had this information or some of them did not. This discrepancy was quite apparent in quite a few of the AMD sessions. The committee agreed to take the matter to the general meeting the following day.

As before, frustrations were prevalent among the attendees regarding the continued upward swing of the registration cost.

Hassan Mahfuz, Vice Chair
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Dynamics and Control of Systems and Structures Committee

Bogdan Epureanu is the Technical Program Chair of the upcoming IDETC 2011. Dumitru I. Caruntu is the Chair of the Workshops and Tutorials of IDETC 2011. Albert Luo and Marco Amabili are the organizers of Track 13 Dynamic Systems and Control, and Ahmed Al-Jumaily the Organizer of Track 8 at the upcoming ASME IMECE 2011. The committee elected Prof. Albert Luo of the Southern Illinois University Edwardsville as the new Secretary of the committee. DCSS committee members organized 18 symposia totaling a number of 310 papers and 60 sessions at the upcoming ASME IMECE 2011 and ASME IDETC 2011 as follows.

At the upcoming ASME IMECE 2011 the committee organized 11 symposia in 2 tracks and 41 sessions totaling 223 papers.

Bogdan Epureanu, Marco Amabili, Dumitru I. Caruntu organized 3 symposia spread over 2 tracks and 11 sessions and totaling 61 papers: (a) Symposium on Dynamics and Control of Biomechanical Systems, Track 8 Biomedical and Biotechnology Engineering, Organizers: Dumitru I. Caruntu, Bogdan Epureanu, (b) Symposium on Nonlinear Dynamics, Control, and Stochastic Mechanics, Track 13 Dynamic Systems and Control, Organizers: Marco Amabili, Bogdan Epureanu, and Dumitru I. Caruntu, (c) and Symposium on Dynamics and Control in Micro/Nano Engineering, Track 13 Dynamic Systems and Control, Organizers: Dumitru I. Caruntu, Bogdan Epureanu, and Marco Amabili.

Ahmed Al-Jumaily, Albert Luo, Hamid Hamidzadeh, Mathew Brake, Lei Zuo, Ioannis T. Georgiou, Nikolas Xiros, and Mohammed Younis have been active in organizing 8 symposia in 3 tracks, spread over 30 sessions totaling a number of 162 papers: (a) Symposium on Vibration and Acoustics in Biomedical Applications, Track 8 Biomedical and Biotechnology Engineering, Organizer: Ahmed Al-Jumaily, (b) General, Track 13 Dynamic Systems and Control, Organizers: Matthew Brake, Annie Tangpong, Christian M. Firrone, (c) Symposium on Chaos, Complexity and Synchronization in Dynamical Systems, Track 13 Dynamic Systems and Control, Organizers: Albert Luo, Hamid Hamidzadeh, (d) Symposium on Design and Control of Mechanisms and Robots, Track 13 Dynamic Systems and Control, Organizers: Hong Zhou, Lei Zuo, (e) Symposium on Impact Dynamics and Mechanics, Track 13 Dynamic Systems and Control, Organizer: Matthew Brake, (f) Symposium on Multiscale Symposium on Joints, Track 13 Dynamic Systems and Control, Organizers: Matthew Brake, Michael Starr, Weidong Zhu, (g) Symposium on Robust Reduced-Order Modeling for Control, Diagnostics & Prognostics of Multi-Physics, Large-Scale Systems, Track 13 Dynamic Systems and Control, Organizers: Ioannis T. Georgiou, Nikolas Xiros, (h) Symposium on Design, Fabrication, Dynamics, and Control of Micro and Nano Systems, Track 5 Nano and Micro Materials, Devices and Systems, Organizers: C. Channy Wong, Shaurya Prakash, Mohammed Younis.

At the upcoming ASME IDETC 2011 the committee organized 7 symposia in 2 conferences and 19 sessions totaling 87 papers.
Dumitru I. Caruntu, Marco Amabili, and Bogdan Epureanu organized 3 symposia spread over 2 conferences and 7 sessions and totaling 32 papers: (a) Symposium on Dynamics and Control of Bio-Systems , 23rd Biennial Conference on Mechanical Vibration and Noise (VIB), Organizers: Dumitru I. Caruntu, Bogdan Epureanu, (b) Symposium on Nonlinear Dynamics of Continuous Systems, 23rd Biennial Conference on Mechanical Vibration and Noise, Organizers: Dumitru I. Caruntu, Marco Amabili, Bogdan Epureanu, (c) Symposium on BIO MEMS/NEMS, 5th International Conference on Micro- and Nanosystems (MNS), Organizers: Gou-Jen Wang, Brian Jensen, Dumitru I. Caruntu.
Albert Luo, Hamid Hamidzadeh, Andrew Dick, and Mohammad Younis have been active in organizing or co-organizing 4 symposia spread over 2 conferences and 12 sessions totaling a number of 55 papers: (a) Symposium on Discontinuous Dynamical Systems and Synchronization, 23rd Biennial Conference on Mechanical Vibration and Noise (VIB), Organizers: Albert Luo, Jose Machado, and Ebrahim Esmailzadeh, (b) Symposium on

Vibrations and Controls of Manufacturing Systems, 23rd Biennial Conference on Mechanical Vibration and Noise (VIB), Organizers: Albert Luo, Hamid Hamidzadeh, and Steve Suh, (c) Symposium on Nonlinear mechanics, dynamics, and control in Atomic Force Microscopy, 5th International Conference on Micro- and Nanosystems (MNS), Organizers: Santiago D. Solares, Andrew Dick, and Arvind Raman, (d) Symposium on Dynamics of MEMS and NEMS, 5th International Conference on Micro- and Nanosystems (MNS), Organizers: Jeffrey F. Rhoads, Mohammad Younis, Slava Krylov, and John A. Judge.

Dumitru I. Caruntu, Chair
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Elasticity Committee

The Committee met on November 16th, 2010 during the Vancouver IMECE meeting.
Present at the meeting were Ajit Achuthan, Emmanuel Ayorinde, Yonggang Huang, Hanqing Jaing, Shailendra Joshi, Robert Kukta, Yashashree Kulkarni, Oscar Lopez-Pamies, Pradeep Sharma, Jizhou Song, and Kai-tak Wan.

The Committee discussed nominations for ASME awards and proposed symposia for the 2011 IMECE meeting in Denver. It was decided that the committee would sponsor the following three symposia:

Symposium on Multiphysics Simulations for Solids: Complex interactions between multiphysics, including stress, temperature, electrical and magnetic fields, moisture, fluid, as well as mass transport, appear in various materials in wide spectrum of applications, ranging from nanostructured materials in electronics, ferroelectric and thermoelectric materials in energy conversion, to soft matters for drug delivery and tissue engineering. The efficient and robust multiphysics simulations, either based on finite element method for micro-scale materials or molecular-level simulations (e.g., molecular dynamics and tight-binding simulations) for nano-scale materials, have significant impact on the understanding of the complex physics, and in turn will potentially benefit the general areas from electronics, energy harvesting, to bio-medical applications. This symposium dedicates to coupled mechanical, thermal, electromagnetic, moisture, fluid, and mass transport simulations for solids. Organizers: Harold Park, Boston University, Hanqing Jiang, Arizona State University, Gang Li, Clemson University, Jerry Qi, University of Colorado, Ting Zhu, Georgia Institute of Technology, Eliot Fang, Sandia National Labs, Dong Qian, University of Cincinnati, Spandan Maiti, University of Pittsburgh.

Symposium on Mechanics of thin film and multi-layer materials: This symposium will encompass recent developments in analytical, experimental and numerical analysis of mechanics of thin film and multi-layer materials. Topics of interests include, but not limited to stress and deformation in thin films and their measurement, mechanical properties, fracture and fatigue, interfacial delamination, adhesion, hardness, toughness, creep, thin film patterning, mechanical stabilities and reliability. Both fundamental

research and practical applications of thin film and multi-layer materials are welcome. Organizer: Jizhou Song, Department of Mechanical and Aerospace Engineering, University of Miami.

Symposium on Multi-scale computation and modeling of defects in materials: This symposium aims to bring together researchers involved in the computation of properties of defects such as vacancies, dislocations, cracks, interfaces, surfaces and nano-clusters, using quantum-mechanical, atomistic and mesoscopic models. Focus areas include structure, energetics, nucleation and kinetics of defects, as well as interactions between defects, and their influence on material properties. Theoretical, computational and modeling advances as well as the application of existing methods to study various properties (including structural, electronic and optical) are in the scope of this symposium. The range of physical models spans quantum mechanics-based electronic-structure theories and atomistic/molecular dynamics using empirical potentials and continuum mesoscopic models, as well as simplified model systems. Computational techniques include concurrent multiscale methods, spatio-temporal coarse-graining, as well as methods to extract sub-grid models from fundamental theories. Organizers: Yashashree Kulkarni, Mechanical Engineering, University of Houston, Kaushik Dayal, Civil and Environmental Engineering, Carnegie Mellon University.

Robert Kukta, Chair
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Committee on Fluid-Structure Interaction

This has been an especially productive year for the committee. CFSI organized two minisymposia at IMECE 2010, titled "Computational Methods for Fluid–Structure Interaction" and "Isogeometric Methods". The former minisymposium consisted of four sessions, totaling 20 invited presentations, while the latter minisymposium consisted of two sessions, totaling 10 invited presentations. The Fluid–Structure Interaction minisymposium was organized and chaired by Yuri Bazilevs (UC, San Diego), Kenji Takizawa (Waseda University, Tokyo) and Tayfun Tezduyar (Rice University). The Isogeometric Methods minisymposium was organized and chaired by Bazilevs, Jessica Zhang (Carnegie Mellon University), David Benson (UC, San Diego) and Thomas Hughes (UT, Austin). Both symposia were attended by the US and International participants, who are leading researchers in computational mechanics, computational fluid dynamics, and computational geometry.

Hughes, Bazilevs and Benson organized a workshop "Isogeometric Analysis: Integrating Design and Analysis (IGA 2011)" at the Institute for Computational Engineering and Sciences, The University of Texas at Austin, January 13–15, 2011. The workshop was co-sponsored by The University of Texas and the US Association for Computational Mechanics (USACM). The workshop was part of a newly established USACM series of thematic conferences. The workshop brought together experts in computational geometry and

computational mechanics interested in the development of the new generation of simulation procedures based on modern methods of computational geometry. Over 100 participants were in attendance, which exceeded the expectations of the workshop organizers. The mini symposium enjoyed good participation and attendance from both well-established and young researchers in the respective fields. We expect IGA to become a regular USACM thematic conference in the coming years.

The CFSI is organizing two invited minisymposia: "Fluid–Structure Interactions" at Coupled Problems 2011 (to take place this June on Kos Island, Greece), and "Fluid–Structure Interaction" at Marine 2011 (to take place this September in Lisbon, Portugal). Both conferences are part of the European Community on Computational Methods in Applied Sciences (ECCOMAS) and International Association for Computational Mechanics (IACM) thematic conference series. The minisymposium at Coupled Problems 2011 bears a special significance as it is dedicated to the celebration of the 70th birthday of Professor Ahmed Sameh (Purdue University). Professor Sameh is a leading researcher in scientific computing. His well-cited work focuses on the solution of large-scale systems of linear equations arising in the numerical discretization of the equations of fluid and structural mechanics, as well as other applications. We wish Professor Sameh a happy birthday and are looking forward to a fruitful exchange of ideas. Takizawa, Bazilevs and Tezduyar are the minisymposium chairs. The minisymposium at Marine 2011 is chaired by Bazilevs and Tezduyar. The minisymposium emphasis is on the application of modern methods of FSI to problems in marine engineering.

Roland Wüchner (TU, Munich), a member of the CFSI, and Kai-Uwe Bletzinger (TU, Munich) are organizing a minisymposium titled "Fluid–Structure Interaction and Wind Engineering" at an IACM special interest conference, Fifth International Conference on Textile Composites and Inflatable Structures (Membranes 2011). The conference will take place in Barcelona, Spain, October 5–7, 2011. The objectives of Membranes 2011 are to collect and disseminate state-of-the-art research and technology for design, analysis, construction and maintenance of textile and inflatable structures.

Finally, CFSI would like to announce the upcoming conference "Advances in Computational Mechanics: A Conference Celebrating the 70th Birthday of Thomas J.R. Hughes". The conference, to take place in San Diego, CA on February 24–28, 2013, is organized by Bazilevs, Takizawa and Tezduyar. The conference is in part sponsored by IACM and will include a Special Track: 17th International Conference on Finite Elements in Flow Problems. For more information, visit the conference announcement Website (http://www.tafsm.org/TH70/).

Yuri Bazilevs, Chair
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Kenji Takizawa, Co-Chair
ktakiz@tafsm.org

Materials Processing and Manufacturing Committee

The committee met on November 15, 2010, at 2:00-3:00pm, in Vancouver, British Columbia.

Chair: Xin Wu, Wayne State University, Detroit, Michigan, xwu@eng.wayne.edu

Vice Chair: Dr. Harish Cherukuri, Univ. of North Carolina at Charlotte, hcheruku@uncc.edu

Open discussion

1. Strategies to increase participation in the technical committee and make the committee more active.
2. People interested in materials processing and manufacturing go to the ASME Manufacturing Science and Engineering conference instead of the IMECE.
3. Timing of the committee meeting compared to the symposia timing (this concern was also raised by Prof. Maniatty via email).

Discussion on merging the AMD MPM committee and the Materials Division Materials Processing committee: Xin mentioned that, last year, he broached the topic with the chair of the MD: Materials Processing committee. Xin suggested that we should pursue this again. Harish Cherukuri will contact Prof. Ram Kumar regarding this.
Xin also talked about how to make the committee more international. A suggestion was made to include participants from China, Korea and Japan. Xin mentioned the suggestions made by Prof. Hugh Bruck via email: (a) we should recommend someone for ASME fellowship, (b) the committee needs to identify what the most relevant research areas are. There is a lot of interest in nanomanufacturing.

MPM considers proposing symposia in the following areas: Functional Materials Processing, Energy saving, generation and storage, Sustainability, Dissimilar joining at different scales, Mechanics of Materials Processing, Mechanical Systems, Biomaterials Processing, Biocomposites.

Also, we should invite Prof. Sheng Liu to hold a symposium.

If any of the MPM members are interesed in organizing a symposium, please send an email to Prof. Xin Wu at xwu@eng.wsu.edu. The proposed topics will then be distributed to the MPM members and then submitted to ASME.

Another suggestion was to organize a student process design analysis competition. Suggest to the ASME to organize tours to the companies local to Denver during IMECE 2011.

Symposium Proposals for IMECE 2011:

Sponsoring Divisions and Technical Committees
Applied Mechanics Division – Material Processing and Manufacturing TC
Material Division – Material Process TC

For IMECE 2011, the following symposia have been proposed and/or will be organized by the AMD-MPM TC:

Track 12 Mechanics of Solids, Structures and Fluids
12-26 Micro/Nano-Manufacturing for MEMS, Nano Interconnects, LED, and Solar Cells
12-27 Advanced Material Joining
12-28 Multiscale Damage and Failure in Engineering Materials

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Harish Cherukuri, Vice Chair
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