Applied Mechanics Division

Newsletter
2018

Applied Mechanics Executive Committee (2017-2018)

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Dennis M. Kochmann,
Newsletter Editor

Applied Mechanics Division
2017-2018 Executive Committee

Balakumar Balachandran
Vice-Chair

Yonggang Huang
Program Chair

Pradeep Sharma
Chair

Yuri Bazilevs
Program Vice-Chair

Pradeep Guduru
Secretary

Message from the Chair

The Applied Mechanics Division (AMD) of the ASME is a rather unique organization and arguably one of the most important entities that represents the interests of mechanicians worldwide. It was my privilege to serve on the AMD executive committee for the past five years. The experience was quite humbling as I became intimately aware of the breadth and depth of the contributions of our community and the passion that we bring to our chosen field.

Together with the other members of the executive committee, we collectively tackled several difficult issues faced by the division. This was a unique learning experience and I would like to thank the members of the committee who provided outstanding mentorship and friendship during this period: ***Larry Bergman***, ***Huajian Gao***, ***Peter Wriggers***, ***Arun Shukla***, ***Bala Balachandran***, ***Yonggang Huang***, ***Yuri Bazilevs***, and ***Pradeep Guduru***. Both ***Dennis Kochmann*** and ***Pedro Reis*** served as recording secretary and, later, Dennis also took over the role of the AMD newsletter editor. Aside from performing an outstanding job on these important responsibilities, they proved to be a fountain of creative ideas on how the AMD should function effectively. In the coming year, Pedro will replace Dennis as the AMD newsletter editor while ***Celia Reina*** will assume the role of the recording secretary.

As was well articulated by the previous chair of AMD, Arun Shukla, in the previous newsletter, we faced many vexing challenges in our relationships with the ASME headquarters – chief among which was financial autonomy of the divisions. I am happy to report that after several years of sustained efforts by the executive committee, much of those troubles are now a thing of the past. ASME recognized the concerns of our division and those of others and have instituted several welcome reforms. I am happy to therefore exit on a rather optimistic note and believe that the future of the AMD will only brighten.

I am happy to welcome the new incoming member of the executive committee: ***Taher Saif***. With its new incoming leader, Bala Balachandran, the AMD is in good hands and I look forward to the many new and exciting things on the horizon.

Pradeep Sharma,
2017-2018 Chair, Applied Mechanics Division

International Mechanical Engineering Congress & Exposition (IMECE)

IMECE 2017

IMECE 2017 was held in Tampa, Florida, from November 3-9, 2017. ***Yonggang Huang*** and ***Yuri Bazilevs*** were the Chair and Vice-Chair, respectively, of Track 12, Mechanics of Solids, Structures and Fluids, the traditional forum for AMD. The Medalists' session included presentations by the Daniel C. Drucker medalist, ***David Parks*** (MIT), the Thomas K. Caughey Dynamics Awardee, ***Richard H. Rand*** (Cornell University), and the Ted Belytschko Applied Mechanics Awardee, ***J.S. Chen*** (University of California at San Diego). The Warner T. Koiter Lecture was delivered by ***Wei Yang*** (Natural Science Foundation of China).

The Applied Mechanics Division's annual Honors and Awards Banquet and Ceremony on Tuesday night was well attended. A highlight of the evening was the Timoshenko Medal acceptance speech by ***Viggo Tvergaard*** (Technical University of Denmark). Others receiving Society-level awards included ***Wei Yang***, the Warner T. Koiter Medalist, and ***David Parks***, the Daniel C. Drucker Medalist. Those receiving Division-level awards were ***J.S. Chen***, the Ted Belytschko Applied Mechanics Awardee, ***Richard H. Rand*** (Cornell University), the Thomas K. Caughey Dynamics Awardee, and ***Jose Andrade*** (California Institute of Technology), the Thomas J. R. Hughes Young Investigator Awardee. In view of the large number of high-quality proposals, Professor ***Jennifer Haythornthwaite*** of The Johns Hopkins University, representing the Haythornthwaite Foundation, supported four HRIG awards. The four successful proposals were authored by ***Yue Fan*** (University of Michigan, "*Mechanical Heterogeneity and Energy Dissipation in Metallic Glasses*"), ***Edmon Perkins*** (Auburn University, "*Energy Localization in Nonlinear Dynamical Systems: Design, Measurement, and Control*"), ***Matt Pharr*** (Texas A&M University, "*Electro-chemo-mechanics of lithium metal anodes for high-capacity batteries*"), and ***Ankit Srivastava*** (Texas A&M University, "*Unraveling the microstructural effects on ductile fracture in multiphase materials*").

IMECE 2018

Preparations are well under way for IMECE 2018, to be held in Pittsburg, PA, from November 9-15, 2018. ***Yuri Bazilevs*** and ***Pradeep Guduru*** will serve as chair and co-chair, respectively, of Track 12,

Mechanics of Solids, Structures and Fluids. The following AMD members will be recognized at the AMD Honors and Awards Banquet and Ceremony on Tuesday, November 13:

Timoshenko Medal:	***Ares J. Rosakis*** (California Institute of Technology)
Drucker Medal:	***David M. Barnett*** (Stanford University)
Koiter Medal:	***Taher Saif*** (University of Illinois at Urbana-Champaign)
Ted Belytschko Appl. Mech. Award:	***Tayfun E. Tezduyar*** (Rice University)
Thomas K. Caughey Dynamics Award:	***Firdaus E. Udwadia*** (University of Southern California)
T.J.R. Hughes Young Invest. Award:	***Liping Liu*** (Ruttgers University) and ***Dennis M. Kochmann*** (ETH Zurich/Caltech)

Please join us in congratulating all awardees.

THE 2017 AMD AND ASME SOCIETY AWARDS

TIMOSHENKO MEDAL — Viggo Tvergaard

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 AMD, it honors Stephen P. Timoshenko, world-renowned authority in the field, and it commemorates his contributions as author and teacher.

The 2017 Timoshenko Medal was awarded to ***Viggo Tvergaard***, Professor Emeritus in the Department of Mechanical Engineering at Denmark Technical University (DTU), *"for tremendous impact on the development and application of models for porous ductile solids and creating powerful theoretical and numerical tools applicable to the study of full-scale ductile rupture problems".* The acceptance speech that follows below was delivered at the AMD Honors and Awards Banquet at the ASME International Mechanical Engineering Congress and Exposition held in Tampa, Florida on Tuesday, November 7, 2017:

"It is a great honor for me to receive the Timoshenko Medal. In particular I am very impressed when I look at the names of those who got it before me. Many thanks to those who have nominated me, and to those who have selected me for this honor.

Already during my PhD studies I read Timoshenko's autobiography "As I Remember". Strong early career, obtaining chairs in Strength of Materials in Kiev and in St. Petersburg. Interrupted by the Russian revolution, and then a slow buildup of his second strong career in the US. Very impressive.

The Technical University of Denmark, where I studied, and where I work, is an old respected technical university. In international rankings we are often among the 5 to 10 best technical universities in Europe. The university was started in 1829 by the physics professor Hans Christian Oersted. He was the

scientist who discovered electromagnetism. During my studies, many departments still had rather little research; it is much better now where the level is kept up by strong competition. But, for my final year I had found two groups that were very active and had focus on applying mathematics. One was solid mechanics, the other was operational analysis and statistics. I had thought of continuing with the latter, but then my solid mechanics professor, Frithiof Niordson, asked if I would do a PhD study with him. When that had finished he asked if I would like to start as an Assistant Professor, and it has continued about like that.

Frithiof Niordson had studied in Stockholm, at professor Folke Odqvist who was an internationally active scientist in our field. Frithiof went to Brown University right after the second world war to get a PhD with Bill Prager. Frithiof was very smart, and he also had the ability to develop strong networks, e.g. with Bernie Budiansky who was his co-student at Brown and became a lifelong friend. Through this network I met Bernie's student, John Hutchinson, and John's student, Alan Needleman, two persons who have had strong influence on my research work, and who have become close friends. Frithiof spoke fluently Russian. His mother was Russian, and from his Russian network I later developed close contacts to Grisha Barenblatt.

For the PhD I worked on a generalized beam theory that could describe unusual phenomena seen experimentally in a Swedish turbine factory. It was interesting enough, and I published two papers in Solids and Structures, but nobody cared and nobody cited it, except that in my second paper I must have cited the first one. Still most of a year of my PhD stipend was left. I was very interested in elastic post-buckling theory, and I asked John Hutchinson, who was then a visiting professor, about a problem I could use to learn that. He mentioned a nice problem on non-linear mode interaction in post-buckling. But two days later he asked me to wait, because it was really an idea he got from Warner Koiter. Shortly after, I got a very kind letter from Koiter, in which he said that it would be interesting to see my results, and that he would probably also work on it himself later on. He did, a couple of years later. After that, for the next about 25 years, whenever I met Koiter, he was always very supportive and took interest in my work.

In May 1971, I went to my first Congress, CANCAM 3 in Calgary. This was my first time in an airplane. I heard Koiter lecture on elastic stability. Den Hartog in a subsequent lecture used buckling of an oil drilling tube to tease Koiter by asking how a structure with only tensile stresses can buckle. And I heard a very interesting lunch-lecture by G.I. Taylor. I also met several other strong scientists who later got to play a role in my life. After the congress Frithiof had arranged a trip for me to visit some of his friends, in order to broaden my mind, I think. In the University of Seattle Carl Pearson received me for a day and showed me some of their research. At the Courant Institute in New York Joe Keller took care of me, and at Harvard John Hutchinson was my host. Here I also met Bernie Budiansky, Lyell Sanders and others. And afterwards John and his family took me along to New Hampshire where a bunch of their friends had planned a day trip of canoeing down through rapids. We were about 10 canoes. Clearly there were colorful sides to solid mechanics.

Several foreign scientists, most from the US, spent their sabbatical at our Department in the early 1970'ies. At that time Frithiof Niordson had started the Danish Centre for Applied Mathematics and Mechanics, DCAMM, which helped increasing the focus on our activities. In the fall of 1973 the visitor was Alan Needleman, who then worked as an Assist. Prof. at the Math. Dept of MIT. We decided to collaborate on a paper, it turned out we interacted very well and that we enjoyed it, so it has been going on ever since. In the first years it was plastic buckling of various structural elements, but it also developed into various finite strain problems and fracture problems.

In 1976 my family had bought a sailboat, and I started sail racing together with some PhD students. But we did not win. Therefore, for some months I took more interest in another type of mechanics, i.e. fluid

dynamics, and I also communicated more with my fluid mechanics colleagues. One of the things I learned about, and used in the races, is the importance of the length of the laminar separation bubble at the front of the genoa. It was only racing on a local Danish level, but at least after that we started to win some of our races.

In 1978 my colleague Jes Christoffersen and John Hutchinson developed J2 corner theory, a detailed description of the elastic-plastic response at a vertex on the yield surface. I had just defended the big old-fashioned doctor degree in Denmark, so I needed something else to do. John suggested that he and I should use the J2 corner theory to model surface wave instabilities on an elastic-plastic solid, like ocean waves with zero wave speed. We could relate that to experiments that John had just seen in Stockholm. The same year I did some unit cell model analyses for a porous plastic solid to try to estimate the accuracy of the recently developed Gurson model.

A very important trip for me was the half-year sabbatical I had at Brown University in 1979. I was obviously there to collaborate with Alan, and we worked on buckling localization and on applications of the J2 corner theory program. But also meeting and discussing with the very strong solid mechanics group at Brown was a great experience for me, Jim Rice, Ben Freund and Bob Asaro were all very positive and friendly. At the same time I could still work on a paper with John, as Harvard was only a short drive away.

After the sabbatical a long period started, where I visited at Brown every year, and Alan visited in Denmark every year. We worked hard to produce new research. In addition, at each visit to Brown it was very inspiring for me at to discuss mechanics with the colleagues who were there at the time, including Ben Freund, Subra Suresh, Michael Ortiz, Kyung-Suk Kim and Fong Shih.

During this period a friend of mine moved to a chemical company, Haldor Topsoe Ltd., located a few kilometers from my university. They are very interested in research, spending much money on that, but not solid mechanics research. Their focus is on surface physics and chemistry to improve their expertise in catalysis. However, solid mechanics is a limiting factor, as some of the containers in their factories operated at 950 degrees C and at 35 atmospheres of internal pressure, and the chemistry inside would be more efficient under higher pressure and higher temperature. They asked if I would consult on creep rupture. Could be fun, all I knew about it was continuum damage mechanics following the ideas of Kachanov and Rabotnov. But reading about it I soon learned that Jim Rice had done very interesting micromechanical work, analyzing diffusive growth of grain boundary cavities, and that also Alan and John had contributed to the area. I could use these results to develop constitutive models and for some years I served as a permanent consultant to the company, being member of their Scientific Advisory Committee. During this period I got very involved in studying the works of strong materials scientists such as Mike Ashby, Ali Argon, Brian Dyson, and others.

In the years with my little extra job in the chemical company I published several papers on creep rupture, all single author papers. This probably is not so typical in our field, but while I much enjoy working with colleagues, and have worked with many different co-authors over the years, I also like working alone, and this covers a good part of the papers I have published.

We all do research all the time. It is exciting and takes all our effort. But, on and off something happens that interrupts the daily routine of teaching and research. About 30 years ago the President of our University telephoned me one day in January and said he would like to persuade me to give the Feast Lecture at the annual party of the University in April. He explained it had to be exactly 20 minutes, technical, popular and somewhat entertaining. After a moment's consideration I said yes. At least I would try something different. But as the time approached I became more nervous. The room can seat 1500 persons, and it was full. At the first row was the Queen of Denmark and her husband the Prince,

together with members of the government, the ministers of education, research, etc, and many other important people. I used a couple of the experiences of G.I. Taylor, taken from his lunch lecture in Calgary, including his description of how pilots 100 years ago tried to find out what was up and down when they flew through a big cloud. Otherwise I mainly showed slides inspired by my own research, it seemed to work.

Around 1990 Erik van der Giessen asked if he could spend a year with me as a postdoc. He came from the group of professors Besseling and Koiter in Delft, and he was funded by the Dutch academy of sciences. I knew he was a young star, so I was very pleased to receive him. Indeed it became a very productive collaboration. We first continued the work on the micromechanics of creep rupture, and also did other things. After the first year Erik came back for about a week every year for a number of years.

Another of these interruptions of the daily routine happened one day in 1995 when I received a telephone call asking if I would join the Board of Directors of a Danish company, called Aalborg Industries Ltd, also known as Aalborg Boilers. In the afternoon the CEO of the company and a representative of the owners came and talked to me, and so I started doing that beside my research. The other board members were directors from Danish companies, and an earlier leader of the blacksmith union who was very well known by Danes. They were not interested in solid mechanics. We flew to meetings there 6 or 7 times every year, in the western part of Denmark. The company had close to 20 subsidiaries spread over the world, and bought one or two new ones every year. At the end we were bought, so this part of my activity ended. At that time, the company had an annual turnover of about 2 billion Danish kroner, and an annual profit of about 100 million D. Kr. My conclusion afterwards was that this kind of activity gives an insight that would be good for every professor of mechanical engineering.

At about the same time a Japanese scientist, Mitsutoshi Kuroda, asked if he could come and spend a year with me. He came from a rather unknown private university, but I quickly learned that he was very strong and I realized that he would soon become one of the strongest plasticity researchers of Japan. Indeed soon after the visit he moved to one of the known state universities, where he is now a professor. We worked on topics relating to plastic flow localization, crystal plasticity, and non-local plasticity. In the years after the first visit Mitsutoshi returned several times for shorter visits, and it has been very productive for both of us.

IUTAM, the International Union of Theoretical and Applied Mechanics, has played a rather big role throughout my professional life. Our department head for many years, Frithiof Niordson, was very active in the Bureau of IUTAM, and he argued that this organization is very important for representing our field internationally, for keeping our subject visible and for supporting international collaborations. I took the same attitude, and whenever asked to do something for IUTAM I have said yes, many different kinds of duties. Therefore, when I was asked in 2012 if I would be willing to serve as the President of the Union, I also said yes, and did it for four years.

I have described that international contacts and collaborations have had a strong influence on my research activities. But naturally, most of my time has been spent as a teacher and researcher in Denmark. Among my teaching duties has been several first or second year classes with up to 200 students, so many thousands of previous students know me, and in the little country I live in I frequently meet some of them. It has been inspiring to be the advisor of many Master Thesis students, and of more than 20 PhD's. In particular I would like to mention the four of my previous PhD's who are colleagues in the solid mechanics group of our Department for Mechanical Engineering, Christian Niordson, Brian Legarth, Kim Nielsen and Ann Bettina Richelsen. They are working hard on materials mechanics research with their PhD students. We also have strong research groups on topology optimization and

on dynamics. I will add that in our group we also consider John Hutchinson and Alan Needleman part of Danish mechanics.

Finally, thanks for listening to this story about mechanics in a small country, and thanks for your patience.

Viggo Tveergard
Professor Emeritus, Department of Mechanical Engineering
Denmark Technical University

DANIEL C. DRUCKER MEDAL — David M. Parks

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 2017 Daniel C. Drucker Medal was awarded to ***David M. Parks***, Professor of Mechanical Engineering at MIT, "*for seminal contributions to the formulation of constitutive theories and computational procedures for large inelastic deformation and failure of metals and polymers".*

WARNER T. KOITER MEDAL — Wei Yang

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 2017 Warner T. Koiter Medal was given to ***Wei Yang***, president of the National Natural Science Foundation of China and a professor in the Institute of Applied Mechanics at Zhejiang University, Hangzhou, China, "*for fundamental contributions in advancing the understanding of crack tip singula-*

rity field, static and fatigue failure mechanisms for mechatronic reliability, and deformation mechanisms of nanocrystalline metals; as well as for global leadership in shaping scientific research policy and fostering international collaboration".

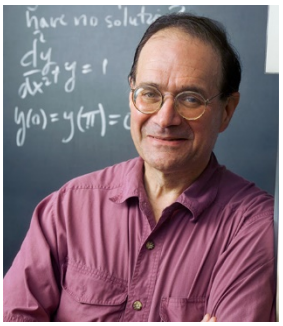
TED BELYTSCHKO APPLIED MECHANICS AWARD — J.S. Chen

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 award was established in 1988 and was renamed the *Ted Belytschko Applied Mechanics Award* in 2008.

The 2017 Ted Belytschko Applied Mechanics Award was conferred upon ***J.S. Chen***, William Prager Chair Professor of Structural Engineering and Director of the Center for Extreme Events Research at UCSD, "*for his seminal contribution to the development of nonlinear finite element; stabilized Galerkin and collocation mesh free methods; as well as their application to multiscale materials modeling, solids, and structures subjected to extreme loading conditions".*

THOMAS K. CAUGHEY DYNAMICS AWARD — Richard H. Rand

The Thomas K. Caughey Dynamics Award was 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 2017 Thomas K. Caughey Dynamics Award was conferred upon ***Richard H. Rand***, Stephen H. Weiss Presidential Fellow and Professor in the Department of Theoretical and Applied Mechanics at Cornell University, "*for seminal contributions to the field of nonlinear dynamics*".

THOMAS J.R. HUGHES YOUNG INVESTIGATOR AWARD — José E. Andrade

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 award was established in 1998 and renamed the Thomas J.R. Hughes Young Investigator Award in 2008.

The 2017 Thomas J.R. Hughes Young Investigator Award was given to ***José E. Andrade***, George W. Housner Professor and Cecil and Sally Drinkward Leadership Chair in the Department of Mechanical and Civil Engineering at the California Institute of Technology, "*for seminal research contributing to the development of fundamental understanding of the multiscale and multiphysics behavior of porous media, with special application to geological and engineered infrastructure materials*".

2017 ASME FELLOWS

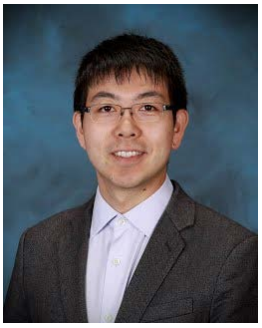
The following distinguished colleagues became Fellows of the American Society of Mechanical Engineers: ***Alper Erturk***, ***Benjamin Hantz***, ***Ellen Kuhl***, ***Ivatury S. Raju***, ***Weiju Ren***, ***Mark Tschopp***, and ***Zheng Hong Zhu***. Congratulations!

2017 HAYTHORNTHWAITE FOUNDATION AWARDS

Haythornthwaite Research Initiation Grants

In 2011 the Applied Mechanics Division, through the generosity the Haythornthwaite Foundation, established a new divisional award, the **Haythornthwaite Research Initiation Grant**. This new grant targets university faculty that are at the beginning of their academic careers engaged in research in theoretical and applied mechanics. The four recipients of the 2017 grants were **Yue Fan** (University of Michigan), **Edmon Perkins** (Auburn University), **Matt Pharr** (Texas A&M University) and **Ankit Srivastava** (Texas A&M University). The winning project titles and descriptions are provided in the following.

Haythornthwaite Research Initiation Grant — Yue Fan



Mechanical Heterogeneity and Energy Dissipation in Metallic Glasses: Due to the disappearance of lattice periodicity and subsequently the absence of conventional defects (e.g. dislocations, grain boundaries, etc), metallic glasses can reach very high mechanical strength that is much closer to materials ideal strength than their crystalline counterparts do, which makes them immediately attractive for structural applications. However, glassy materials in general suffer from the problems of shear bands formation and work softening, which result in very low plasticity and have been the main hurdles for their widespread use. The key challenge of addressing these issues is that, in stark contrast to their crystalline counterparts, glasses represent complex non-equilibrium states of matter that contain very high levels of disorder, which make the concept of "defects" (or "carriers of plastic deformation") cannot be uniquely defined. In this proposal, we plan to overcome such challenge by employing the perspective of potential energy landscape (PEL), which simultaneously stems from atomic interactions and thus does not require any empirical assumptions of "defects". The goal of this research project is to understand and predict how the underlying PEL structure of metallic glasses determine the critical phenomena concerning energy dissipation, dynamic heterogeneity (e.g. shear bands formation) and memory effect (e.g. thermomechanical hysteresis). The outcome of this proposed study will identify the optimized routes to engineer the PEL structure, and thus facilitate developing better glassy materials with improved mechanical properties.

Haythornthwaite Research Initiation Grant — Edmon Perkins

Energy Localization in Nonlinear Dynamical Systems: Design, Measurement, and Control: As engineered systems become lighter and more flexible, nonlinear and stochastic effects will play a greater role in the system dynamics. For this reason, it is crucial to find better, faster, and more robust methods of incorporating tuned nonlinearity into physical systems in order to control, model, and understand these nonlinear and stochastic effects. In order to enhance the benefits while minimizing the detriments of nonlinearity and stochasticity, methods will need to be developed to adjust these effects in physical systems. As it is a prototypical system for other more complex systems, this Haythornthwaite Research Initiation Grant will be used to fabricate and study a nonlinear ring lattice, which is capable of exhibiting energy localizations. To facilitate testing, experiments will be 3D printed, and high-speed photogrammetry will be implemented to measure the dynamic response.

Haythornthwaite Research Initiation Grant — Matt Pharr

Electro-chemo-mechanics of lithium metal anodes for high-capacity batteries: The objective of this project is to construct metallic Li anodes with a mechanically robust and safe design. Compared to existing Li-ion systems, when paired as a Li-S or Li-air battery, development of a stable Li metal anode will enable higher energy and power capabilities while reducing weight and volume. To this end, we will implement a complementary theoretical and experimental approach to elucidate electrochemically induced stress, fracture, and morphological changes in lithium metal during electrochemical cycling. Namely, we will perform electro-chemo-mechanical tests on Li metal anodes and develop new continuum mechanics models to predict fracture and deformation (such as dendrite formation) of Li metal. Properties measured from the mechanical tests will inform the continuum models for rational design of coating materials, architectures, and electrochemical conditions that mitigate mechanical degradation during electrochemical cycling.

Haythornthwaite Research Initiation Grant — Ankit Srivastava

Unraveling the microstructural effects on ductile fracture in multiphase materials: A material's fracture resistance depends on its resistance to the creation of free surfaces, as well as its deformation characteristics, which in turn are influenced by the material's microstructure and the imposed loading conditions. The changes in the microstructure that lead to increased dissipation can greatly enhance the fracture resistance of the material. Following this, the specific objective of this research is to investigate the effect of microstructure on ductile fracture of multiphase materials using in-situ SEM fracture tests and microstructure-based finite element modeling. The Haythornthwaite Research Initiation Grant is enabling us to develop capabilities and expertise to carry out quantitative measurements of the deformation field on the specimen surface using image correlation techniques at microstructural scale.

AMD HONORS AND AWARDS BANQUET, IMECE 2017

At this point, the AMD normally presents photos from the AMD Honors and Awards Banquet showing the most memorable moments. Unfortunately, this year ASME failed to provide the photographer; the below images were taken by *Pedro Reis* who thankfully stepped in with his cell phone.


AMD Chair Pradeep Sharma presents the Timoshenko Medal to ***Viggo Tvergaard*** who gives his Timoshenko speech at the AMD Honors and Awards Banquet (see the transcript on page 4).


Pradeep Sharma and the banquet participants are being addressed by Warner T. Koiter Medalist ***Wei Yang*** (*left*) and Daniel C. Drucker Medalist ***David S. Parks*** (*right*).


J.S. Chen receives the Ted Belytschko Applied Mechanics Award from AMD Chair Pradeep Sharma (*left*), ***Richard H. Rand*** receives the Thomas K. Caughey Dynamics Award (*right*).

José Andrade, the Thomas J.R. Hughes Young Investigator Awardee, is adressing the assembly (*left*). Yong Zhu (*right*) is the recipient of the Eshelby Eshelby Mechanics Award for Young Faculty.

NEWS FROM THE TECHNICAL COMMITTEES

The reports that follow are from some of the Technical Committees (TCs) of the Division of Applied Mechanics. Those TCs not represented here unfortunately did not provide information.

If you are interested in the activities of a particular TC, please feel free to contact the leadership of the committees.

Computing in Applied Mechanics (CONCAM) Technical Committee

Chair: Caglar Oskay, Vanderbilt University, USA (2017-2019)
Vice-Chair: Dong Qian, University of Texas at Dallas, USA (2017-2019)

The AMD CONCAM Technical Committee held its annual meeting on Tuesday, November 7, 2017 at the Tampa Marriott Waterside Hotel, Meeting Room 2, 2nd Floor, Tampa, FL, USA. 20 members were in attendance during the meeting.

At IMECE 2017, the committee members organized 7 multidisciplinary topics:

1. *Modeling of the Fracture, Failure and Fatigue in Solids*
2. *Multiphysics Simulations and Experiments for Solids*
3. *Multi-scale Computations in Fluids, Structures, and Materials*
4. *Peridynamic Modeling of Material Behavior*
5. *Mechanical Metamaterials*
6. *Phase Transformations in Materials Processing and Their Effects on Mechanical Properties*
7. *Congress-Wide Symposium on Additive Manufacturing: Failure of Additively Manufactured Materials*"

The CONCAM committee will inaugurate two special events during IMECE 2018. The first is a new student *Best Poster Competition* to increase the participation and excitement of graduate students working on computational mechanics in the AMD activities and community. The second is the *Keynote Lectures on Computational Mechanics* series that will feature talks from four of the foremost computational mechanics researchers.

Additionally, the following mini-symposia were proposed for IMECE 2018:

1. *Multiphysics Simulations and Experiments for Solids* organized by Dong Qian (University of Texas At Dallas, USA), Hanqing Jiang (Arizona State University, USA), Harold Park (Boston University, USA), Gang Li (Clemson University, USA), and Xianqiao Wang, University of Georgia, USA)
2. *Multiscale Models and Experimental Techniques for Composite Materials and Structures* organized by Dianyun Zhang (University of Connecticut, USA), Caglar Oskay (Vanderbilt University, USA), Evan Pineda (NASA Glenn Research Center, USA) and Charles Wojnar (Missouri University of Science and Technology, USA).
3. *Mechanical Metamaterials* organized by Jongmin Shim (University at Buffalo, USA), Lifeng Wang, (Stony Brook University, USA), Jie Yin (Temple University, USA), Yaning Li, (University of New Hampshire, USA), Sung Hoon Kang (Johns Hopkins University, USA), Eduard Karpov (University of Illinois at Chicago, USA) and Jaehyung Ju (Shanghai Jiao Tong University, China).
4. *Processing and Performance of Nanocomposites* organized by Davood Askari (Wichita State University, USA) and Mohammad Naraghi (Texas A&M University, USA).
5. *Multi-Scale Computations in Fluids, Structures and Materials* organized by Yozo Mikata (Bechtel Corp., USA) and Glaucio Paulino (Georgia Institute of Technology, USA).
6. *Modeling of the Fracture, Failure and Fatigue in Solids* organized by Huijuan Zhao (Clemson University, USA), Gang Li (Clemson University, USA), Mark Horstemeyer (Mississippi State University, USA), Qingda Yang (University of Miami, USA) and Mohsen Asle Zaeem (Missouri University of Science and Technology, USA).
7. *Peridynamic Modeling of Material Behavior* organized by Florin Bobaru (University of Nebraska-Lincoln, USA), Ibrahim Guven (Virginia Commonwealth University, USA), Erdogan Madenci (University Of Arizona, USA), Pablo Seleson (Oak Ridge National Laboratory, USA) and Stewart Silling (Sandia National Lab, USA).
8. *Congress-Wide Symposium on Additive Manufacturing: Failure of Additively Manufactured Materials* organized by Ashfaq Adnan (University of Texas at Arlington, USA) and H. Eliot Fang (Sandia National Laboratories, USA)

Instabilities in Solids and Structures Technical Committee

Chair: Ryan Elliott, University of Minnesota
Vice-Chair: Edmundo Corona, Sandia National Laboratory

The Instabilities in Solids and Structures (IiSS) Technical Committee has been very active during the 2017-2018 year. The committee is Chaired by Ryan S. Elliott of the University of Minnesota and Vice-Chaired by Edmundo Corona of Sandia National Laboratory. During the past year, the committee has organized sessions at IMECE 2017 in Tampa, FL. Additionally, many IiSS regular participants attended the USNCTAM 2017 conference in Chicago, IL.

At IMECE 2017 the committee organized a minisymposium with five sessions and 25 presentations. At USNCTAM 2018, the committee organized a minisymposium with six sessions and 29 presentations. Each of these sessions was well attended and contributed to the overall success of these events.

The committee is currently organizing a symposium for IMECE 2018 at Pittsburgh, PA with help from Kostas Danas of CNRS, Ecole Polytechnique, France, and Dai Okumura of Osaka University, Suita,

Japan. The symposia organized by the committee have been very successful and regularly attract high-quality presentations and are some of the biggest symposia at these events.

We welcome members of the applied mechanics community to participate by soliciting and actively recruiting high-quality contributions to the symposia sponsored by the Instabilities in Solids and Structures Committee.

Composite Materials Technical Committee

Chair: Caglar Oskay, Vanderbilt University, USA (2017-2019)
Vice Chair: Anastasia Muliana, Texas A&M University, USA (2017-2019)

The AMD Composite Materials Technical Committee held its annual meeting on Tuesday, November 7, 2017 at Tampa Marriott Waterside Hotel, Meeting Room 9, 3rd Floor, Tampa, FL, USA. 12 members were in attendance during the meeting.

At IMECE 2017, the committee members organized 5 multidisciplinary topics:

1. *Multiscale Models and Experimental Techniques for Composite Materials and Structures* organized by Dianyun Zhang, Evan Pineda and Caglar Oskay
2. *Mechanical Metamaterials* organized by Jaehyung Ju, Jongmin Shim, Yaning Li, Sung Hoon Kang and Eduard Karpov
3. *Multi-Field Studies in Heterogeneous Materials: Experimental, Theoretical and Numerical Approaches* organized by Anastasia Muliana, Wahyu Lestari, Rani Elhajjar, Valeria La Saponara, Addis Kidane and Charles Wojnar
4. *Mechanics and Design of Cellular Materials* organized by Muhammad Ali and Huanyu (Larry) Cheng
5. *Multifunctional and Micro/Nano-Structured Materials, Modeling and Characterization* organized by Xin-Lin Gao

The following mini-symposia were proposed for IMECE 2018:

1. *Multiscale Models and Experimental Techniques for Composite Materials and Structures* organized by Dianyun Zhang (University of Connecticut, USA), Caglar Oskay (Vanderbilt University, USA), Evan Pineda (NASA Glenn Research Center, USA) and Charles Wojnar (Missouri University of Science and Technology, USA)
2. *Mechanical Metamaterials* organized by Jongmin Shim (University at Buffalo, USA), Lifeng Wang, (Stony Brook University, USA), Jie Yin (Temple University, USA), Yaning Li, (University of New Hampshire, USA), Sung Hoon Kang (Johns Hopkins University, USA), Eduard Karpov (University of Illinois at Chicago, USA) and Jaehyung Ju (Shanghai Jiao Tong University, China)
3. *High-Performance Nanostructural Materials and Nanocomposites* organized by Yuris Dzenis (University of Nebraska - Lincoln, USA), Dimitry Papkov (University of Nebraska - Lincoln, USA) and Mohammad Naraghi (Texas A&M University, USA)
4. *Multifunctional and Micro/Nano-Structured Materials Modeling and Characterization* organized by Xin-Lin Gao (Southern Methodist University, USA)
5. *Mechanics and Design of Cellular Materials* organized by Muhammad Ali (Ohio University, USA) and Huanyu (Larry) Cheng (Pennsylvania State University, USA)
6. *Processing and Performance of Nanocomposites* organized by Davood Askari (Wichita State University, USA) and Mohammad Naraghi (Texas A&M University, USA)

NEWS FROM THE ASME-AMD JOURNALS

Journal of Applied Mechanics

JAM continues to be the fastest mechanics journal in the world, with the average time for the first round of review to be ~10 days, and second round, if necessary ~25 days (including both authors' revision time and reviewers' re-review time). It has attracted a lot of junior authors in the past 12 months, as well as senior authors such as Profs. Lallit Anand, Bazant, Christensen, Detournay, Dowell, Daining Fang, Deli Gao, Hutchinson, Yonggang Huang, Keh-Chih Hwang, Keer, McMeeking, Needleman, Ortiz, Pipes, JN Reddy, Rice, Zhigang Suo, Tvergaard, Tzu-Chiang Wang, Willam, and Weiqiu Zhu.

Yonggang Huang
Editor, Journal of Applied Mechanics

The Journal of Applied Mechanics Award

The Journal of Applied Mechanics Award is provided by the Applied Mechanics Division of the American Society of Mechanical Engineers to honor the best paper, which has been published in the Journal of Applied Mechanics during the two calendar years immediately preceding the year of the award. The award will be made annually to the corresponding author of the paper who received their Ph.D. no more than 10 years prior to July 1 of the year of award. Corresponding authors who have yet to receive a Ph.D. may also be considered. The award will be presented at the AMD Honors and Awards Banquet at IMECE. The award is selected by a committee appointed by the Technical Editor of JAM, with the Vice-Chair of the AMD EC as the committee chair. Professor ***Charles Wojnar*** from Missouri University of Science and Technology will receive the 2018 JAM Award for his paper "*Linking internal dissipation mechanisms to the effective complex viscoelastic moduli of ferroelectrics*".

Applied Mechanics Reviews

Applied Mechanics Reviews (AMR) publishes state-of-the-art surveys and retrospective reviews of theoretical, computational, and/or experimental advances in the broad areas of applied mechanics and engineering science. Also of interest are original pedagogical treatments of a discipline that could be used in self-study. There are no page limits or page charges for papers published in Applied Mechanics Reviews. The journal accepts unsolicited manuscripts, but contributors are encouraged to first complete an author prospectus and forward this to the editor for initial editorial evaluation. Authors should expect a quick turn-around between initial submission and editorial decision, especially if submission is preceded by correspondence with the editor or members of the editorial board during the development of a manuscript.

The 2018 InCites Journal Citation Reports (Clarivate Analytics) for AMR based on data from 2017 and earlier show a total of 3,868 citations in 2017, up from 3,435 in 2016 and 2,862 in 2015. In 2017, the journal's two-year impact factor without self-citations held steady at 7.787 (up slightly from 7.736 in 2016). Its 5-year impact factor was 8.886, up from 6.452 in 2016.

Scopus journal metrics for 2017 show a jump in CiteScore (the ratio of the number of citations in the present year to items published in the previous three years, divided by the number of papers published in the previous three years) from 4.71 in 2016 to 7.62 in 2017 resulting in an overall seventh-place ranking of the journal in the category of Mechanical Engineering (out of 554 total sources). The SCImago Journal Rank (SJR) which weighs citations by the prestige of the source and corrects for typical citation counts within a subject field similarly increased from 1.733 in 2016 to 2.451 in 2017. Similarly, the source normalized impact per paper by year (SNIP), obtained by dividing the average citation count per paper with the typical citation count within a subject field, increased from 3.100 in 2016 to 4.305 in 2017.

In 2017, Applied Mechanics Reviews published 6 issues, totaling 282 pages. Recent publications include:

1. Steinboeck *et al.*, "Dynamical Models of the Camber and the Lateral Position in Flat Rolling"
2. Yao *et al.*, "A Review of Recent Research on the Mechanical Behavior of Lead-Free Solders"
3. Kochmann and Bertoldi, "Exploiting Microstructural Instabilities in Solids and Structures: From Metamaterials to Structural Transitions"
4. Roy *et al.*, "Review of In Situ Mechanical Characterization of Polymer Nanocomposites: Prospect and Challenges"
5. Tong *et al.*, "A Review of the Rotordynamic Thermally Induced Synchronous Instability (Morton) Effect"
6. Jacobs and Martini, "Measuring and Understanding Contact Area at the Nanoscale: A Review"
7. Olofsson and Lyu, "Open System Tribology in the Wheel–Rail Contact—A Literature Review"
8. Ghaednia *et al.*, "A Review of Elastic–Plastic Contact Mechanics"
9. Helbling and Wood, "A Review of Propulsion, Power, and Control Architectures for Insect-Scale Flapping-Wing Vehicles"
10. Gosselin and Schreiber, "Redundancy in Parallel Mechanisms: A Review"
11. Park *et al.*, "Geometric Algorithms for Robot Dynamics: A Tutorial Review"
12. Losey *et al.*, "A Review of Intent Detection, Arbitration, and Communication Aspects of Shared Control for Physical Human–Robot Interaction"
13. Lang *et al.*, "A Review of Thickness-Accommodation Techniques in Origami-Inspired Engineering"
14. Kelley and Weier, "Fluid Mechanics of Liquid Metal Batteries"
15. Kovacic *et al.*, "Mathieu's Equation and Its Generalizations: Overview of Stability Charts and Their Features"
16. Chen *et al.*, "A Review on Water Vapor Pressure Model for Moisture Permeable Materials Subjected to Rapid Heating"
17. Tabiei and Zhang, "Composite laminate delamination simulation and experiment: a review of recent development"
18. Cai *et al.*, "A survey on fractional derivative modeling of power-law frequency-dependent viscous dissipative and scattering attenuation in acoustic wave propagation"

In addition to individual manuscripts solicited by members of the editorial board, as well as un-solicited manuscripts submitted to the Editor, ongoing initiatives include a special issue of AMR in collaboration with the ASME Journal of Computational and Nonlinear Dynamics (JCND).

The ***AMR Podcast*** series, launched in 2014, features informal conversations on topics ranging from a professional career in science and academia to personal reflections on research funding, scientific

dissemination, and the contributions of applied mechanics to engineering technology. The podcast repository, available at

http://appliedmechanicsreviews.asmedigitalcollection.asme.org/podcasts.aspx
and
https://itunes.apple.com/us/podcast/asme-amr-podcasts/id1078670485?mt=2

includes interviews with Avram Bar-Cohen, David Barnett, Markus Buehler, Howard Stone, Joe Goddard, Anthony Bloch, Karl-Johan Åström, Irene Beyerlein, Philip Holmes, Stuart Antman, Katia Bertoldi, Zhigang Suo, Edwin Kreuzer, Igor Mezic, Julia Greer, Melany Hunt, Gabor Stepan, Thomas Hughes, Rodney Clifton, and Simon Ostrach. Interviews may be listened to online or downloaded for offline use.

Applied Mechanics Reviews is served by an editorial board of *Section Editors* (SEs) and *Associate Editors* (AEs). Section Editors serve as lead sources of creativity and initiative and work closely with the Editor to ensure the integrity and quality of the journal. Associate Editors handle the review process and collaborate with the Editor in soliciting invited contributions to the journal. Recent additions to the editorial board include Michael Leamy (AE). There are several openings on the editorial board in all areas of topical coverage. Interested candidates should contact the editor.

Applied Mechanics Reviews welcomes collaboration in service of the applied mechanics community and continued engagement with its contributors and readers in maintaining high standards of significance, quality and impact.

Harry Dankowicz
Editor, Applied Mechanics Reviews

OTHER ASME-AMD AWARDS

Eshelby Mechanics Award for Young Faculty

The recipients of the 2017 Eshelby Mechanics Award for Young Faculty are Professor ***Celia Reina*** from the University of Pennsylvania and Professor ***Yihui Zhang*** from Tsinghua University. The award will be formally presented at the AMD Honors and Awards Banquet at IMECE 2018. This award is given annually to rapidly emerging junior faculty who exemplify the creative use and development of mechanics. The intent of the award is to promote the field of mechanics, especially among young researchers. The award consists of a $ 1,500 cash prize and a commemorative plaque.