# Applied Mechanics Division

# Newsletter
# 2020

Applied Mechanics Executive Committee (2019-2020)

Message from the Chair

ASME/AMD Medals & Awards

Timoshenko Banquet Speech

Haythornthwaite Foundation Awards

News from the Technical Committees

News from the ASME-AMD Journals

Other Awards

Other News

**Jianliang Xiao**
*Newsletter Editor*

# Applied Mechanics Division
## 2019-2020 Executive Committee

**Yuri Bazilevs**
(Brown University)
Vice-Chair

**Pradeep Guduru**
(Brown University)
Program Chair

**Yonggang Huang**
(Northwestern University)
Chair

**Taher Saif**
(University of Illinois
Urbana-Champaign)
Program Vice-Chair

**Marco Amabili**
(McGill University)
Secretary

## Message from the Chair

It was my privilege to serve on the ASME Applied Mechanics Division (AMD) executive committee for the past five years, and as its chair for the past year. I would like to thank the members of AMD executive committee who provided outstanding mentorship and friendship during this period: ***Peter Wriggers, Arun Shukla, Pradeep Sharma, Bala Balachandran, Yuri Bazilevs, Pradeep Guduru, Taher Saif*** and ***Marco Amabili***. Both ***Pedro Reis*** and ***Celia Reina*** served as recording secretary and, later, Pedro also took over the role of the AMD newsletter editor. In the coming year, ***Jianliang Xiao*** will replace Pedro as the AMD newsletter editor.

I am happy to welcome the new incoming member of the executive committee: ***Glaucio Paulino***. With its new leader, ***Yuri Bazilevs***, the AMD is in good hands. I look forward to continuing to contribute to AMD.

***Yonggang Huang***
*2019-2020 Chair, Applied Mechanics Division*

# International Mechanical Engineering Congress & Exposition (IMECE)

## IMECE 2019

The IMECE 2019 was held in Salt Lake City, Utah, from November 8-14, 2019. ***Pradeep Guduru*** and ***Taher Saif*** were the Chair and Vice-Chair, respectively, of Track 11, Mechanics of Solids, Structures and Fluids, the traditional forum for AMD. The Medalists' session included presentations by the Daniel C. Drucker medalist ***John Bassani*** (University of Pennsylvania), the Thomas K. Caughey Dynamics Awardee ***Anil K. Bajaj*** (Purdue University) and ***Steven W. Shaw*** (Florida Institute of Technology), the Ted Belytschko Applied Mechanics Awardee ***Somnath Ghosh*** (Johns Hopkins University), and the Warner T. Koiter medalist ***K.T. Ramesh*** (Johns Hopkins University).

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 ***J. N. Reddy*** (Texas A&M University). Others receiving Society-level awards included ***K.T. Ramesh*** (Johns Hopkins University), the Warner T. Koiter Medalist, and ***John Bassani*** (University of Pennsylvania), the Daniel C. Drucker Medalist. Those receiving Division-level awards were ***Somnath Ghosh*** (Johns Hopkins University), the Ted Belytschko Applied Mechanics Awardee, ***Anil K. Bajaj*** (Purdue University) and ***Steven W. Shaw*** (Florida Institute of Technology), the Thomas K. Caughey Dynamics Awardee. ***Yihui Zhang*** (Tsinghua University) received the Thomas J. R. Hughes Young Investigator Award. In view of the large number of high-quality proposals, Professor ***Jennifer Haythornthwaite*** of The Johns Hopkins University, representing the Robert M. and Mary Haythornthwaite Foundation, supported five HRIG awards. The five successful proposals were authored by ***Grace Gu*** (University of California at Berkeley, "Rational design of next-generation nanomaterials and nanomachines with atom-by-atom control"), ***Ying Li*** (University of Connecticut, "Understanding Blood Circulation and Tumor Extravasation of Nanoparticles through Fluid-Structure Interaction Simulation and 3D Tumor-on-a-chip"), ***Xin Ning*** (Pennsylvania State University, "Large-Scale Origami-Optoelectronics Hybrid Structures in Harsh Environments"), ***Xueju Wang*** (University of Missouri, "Investigation of the Mechanics of 3D Flexible Architectures and Electronic"), and ***Justin Wilkerson*** (Texas A&M University, "A novel cavitation rheology technique (CRT) to characterize non-linear, anisotropic, and rate-dependent constitutive response of soft matter").

## IMECE 2020

Preparations are well under way for IMECE 2020. It was originally planned to be held in Portland, Oregon, from November 13-19, 2020. But due to Covid-19 pandemic, in-person meetings were cancelled, and it's transitioned to a virtual conference. ***Taher Saif*** and ***Marco Amabili*** 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 17:

| | |
|---|---|
| *Timoshenko Medal:* | ***Mary C. Boyce*** (Columbia University) |
| *Drucker Medal:* | ***Glaucio H. Paulino*** (Georgia Tech) |
| *Koiter Medal:* | ***Anthony Waas*** (University of Michigan) |
| *Ted Belytschko Appl. Mech. Award:* | ***Narayana R. Aluru*** (University of Illinois at Urbana-Champaign) |

*Thomas K. Caughey Dynamics Award:* ***Pol D. Spanos*** (Rice University)

*T.J.R. Hughes Young Invest. Award:* ***Xuanhe Zhao*** (Massachusetts Institute of Technology)

Please join us in congratulating all awardees.

## THE 2019 AMD AND ASME SOCIETY AWARDS

### TIMOSHENKO MEDAL — J. N. Reddy

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 2019 Timoshenko Medal was awarded to ***J. N. Reddy***, the Oscar S. Wyatt Jr. Chair Professor of Mechanical Engineering, Texas A&M University, *"for life-time contributions to research and education in applied mechanics through the authorship of creative and highly-cited papers on variational principles, refined theories of plates and shells, computational methods, and nonlocal theories, and textbooks that have impacted generations of engineers".* 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 Salt Lake City, Utah on Tuesday, November 12, 2019:

*"The Timoshenko Medal was established by ASME in 1957 to recognize the enormous and distinguished works and legacy of Stephen P. Timoshenko as a researcher, teacher, and mentor in the field of applied mechanics. The first recipient was Timoshenko himself, an individual who is considered to be the father of modern mechanics in the United States of America, one who has contributed enormously to the prestige and strength of mechanics as a discipline in this country, and a legend whom I tried to emulate very closely. I want to express my sincere appreciation and gratitude to the Applied Mechanics Division and ASME for bestowing this honor, which has a very special meaning for me, as I will explain shortly. I consider it to be the most significant professional honor of my life, even more than the membership in the National Academy of Engineering and one for which I will be eternally grateful. I will do my best to continue to uphold the legacy of S. P. Timoshenko and live up to the high standard exemplified by the past recipients of the Timoshenko Medal—many of whom are present here tonight. My sincere and deepest respects to them; I feel deeply honored to be included among them. I have been fortunate over the years to have met and be inspired by the works of several previous recipients of the Timoshenko Medal.*

*My presentation starts with a short background of my arrival to the United States of America, my journey through mechanics, and some observations and thoughts about the role and responsibilities of the mechanics community in improving the quality of life and enabling us to build a sustainable society for all its citizens through education and research and development.*

*As for my personal background, I come from a lower middle-income farming family in rural South India. As the youngest of five children, I was the first in my family to go beyond high school. During summer holidays, I used to help my father on the farm, which prepared me to be a hard worker, diligent,*

*and thorough. I went through a five-year integrated Bachelor of Engineering degree that prepared me with a broader engineering background and helped me in the later years to work not only in solid and structural mechanics but also in heat transfer, fluid mechanics, and applied mathematics.*

*When I arrived at Oklahoma State University in the spring of 1969, the first thing that caught my attention was the IBM 360 computer on the campus. While doing assignments in a course on vibrations, I would solve the problems by hand and then write Fortran programs to solve them using the computer. The teacher of the course was very impressed by my interest in the use of computers and suggested that I should work with Professor J. T. Oden, who was at the University of Alabama, Huntsville, at that time. I was fortunate to be accepted by Professor Oden, who has been my teacher, mentor, and friend to this day. That was the beginning of my journey in mechanics. Professor Oden was one of the top researchers in the world and the only engineer who was beginning to work on mathematical foundations of the finite element method. My dissertation topic was on the existence and uniqueness of mixed finite element approximations of boundary value problems as well as the unification of variational principles of theoretical mechanics. Both of the topics led, in addition to several journal papers, to two books with Dr. Oden, who was very kind to let me be a co-author. I learned a lot as a student of Professor Oden. Most importantly, I learned the subjects of applied functional analysis, variational methods, the finite element method, and the ability to explain complicated concepts in simple terms. In later years, the knowledge and writing style made me an effective and passionate teacher as well as a textbook writer who cares about teaching and imparting knowledge to the readers. These topics led me to write books in later years on functional analysis, variational methods, and the finite element method—all as a sole author.*

*After a short period of employment with Lockheed Missiles and Space Company, where I worked on a NASA (Glenn) research project to develop a 3D finite element code to study hypervelocity impact, I joined the University of Oklahoma, Norman, in January 1975. It was there where I was introduced to the subject of composite materials and structures by Professor Charles Bert that would change the course of my professional career and follow the legacy of Timoshenko. Knowing the limitations of classical thin plate and shell theories in capturing inter-laminar stresses, I started working on shear deformation theories for composite laminates. My background in mathematics, mechanics, and the finite element method enabled me not only to conceive novel and improved mathematical models of beam, plate, and shell theories but also to develop locking-free and robust finite element models—an activity that continues to the present day. These works on shear deformation theories have resulted in both scientific advancement as well as technological utility that have helped researchers and practicing engineers in the field of laminated composite structures to extend and apply to real-world problems.*

*When I moved to Virginia Tech in 1980, I was already recognized as a leading researcher in refined theories of composite laminates, plates, and shells, as well as the finite element method applied to a variety of interdisciplinary problems, including structural geology, geophysical fluid dynamics, and coupled fluid flow and heat transfer. The Department of Engineering Science and Mechanics was as good as any mechanics department in the country with well-known researchers like Professors Ali Nayfeh, Leonard Meirovitch, John Junkins (now at TAMU), William Saric (now at TAMU), Kenneth Reifsnider, Hal Brinson, Carl Herakovich, Dean Mook, Liviu Librescu, and Robert Jones, among several others. My teaching of a course on the FEM at Oklahoma and Virginia Tech motivated me to write a textbook due to the lack of a general and self-contained introductory book on the subject. Today, it is one of the most popular books on the subject. The book is also one of the first engineering textbooks to present the finite element method as a numerical technique of solving differential equations, independent of the field of application. As a result, people with no structural mechanics background were able to learn how the method could be used to solve equations arising in other fields. I wrote a very comprehensive book on laminated composite plates and shells that covers anisotropic elasticity, plate and shell theories, analytical solutions, and linear and nonlinear finite element analysis. Art Leissa, former editor-in-chief of Applied Mechanics Reviews, commented in his review of my book that it is the best textbook that he has seen for understanding the most important aspects of plate and shell theories, and containing*

*modern, important aspects which Timoshenko hardly could touch upon at all. I also wrote a book on applied functional analysis and another one on energy principles and variational methods in applied mechanics. The latter replaced the classic book by Langhaar. All of these books are now in at least their second edition.*

*After I moved to Texas A&M University in the summer of 1992, I started working on layerwise theories for composite laminates. I showed how inexpensively the approach could be used to predict 3D stress fields accurately in the edge regions of composite laminates. I have collaborated with Professor C. M. Wang of the National University of Singapore (now he is at the University of Queensland, Australia) to develop algebraic relations between the bending, frequency, and buckling solutions of shear deformation theories in terms of the corresponding solutions of the classical theories.*

*I was one of the first to work on penalty finite element models for fluid flows, including Newtonian and generalized non-Newtonian fluids. These works have been implemented into commercial software NISA (marketed by Engineering Mechanics Corporation) and HyperXtrude (marketed by Altair). During the last 25 years at Texas A&M, I have authored and co-authored many other books, including one on the finite element method in heat transfer and fluid mechanics, another one on nonlinear finite element analysis, two books on continuum mechanics, and two books on finite elements for boundary- and initial-value problems.*

*Another topic that I worked on, in collaboration with Professor Karan Surana of the University of Kansas, was a new paradigm in computational mechanics. Namely, the least-squares finite elements. This paradigm shift from the conventional $c^0$-finite elements based on weak-form Galerkin formulations of the Navier–Stokes equations has proven to be far superior to the weak-form Galerkin formulations that employ ad hoc approaches like upwinding, artificial viscosity, reduced integration, stabilization, and other techniques. The weak-form Galerkin finite element formulations are not well suited for the solution of the Navier–Stokes equations because they do not represent any physical principle. We have shown that the least-squares formulations provide a much more robust computational framework for the solutions of flows of Newtonian and non-Newtonian fluids.*

*During the last decade, I have been working on two major fronts: (1) development of 7-, 8-, and 12-parameter shell theories and their finite elements with my students and Dr. Marco Amabili of McGill University and (2) nonlocal and non-classical continuum mechanics with my colleague Arun Srinivasa and Professors Karan Surana of University of Kansas and Debasish Roy of the Indian Institute of Science. The first one is a continuation of many years of my work on shear deformation theories of plates and shells to develop locking-free shell elements for large deformation analysis of laminated composite and functionally graded structures. The second is a rejuvenation of ideas originated and advanced by Cosserat brothers, Green, Naghdi, Mindlin, Eringen, Hutchinson, and likes, and their implementation into structural theories. These include couple stress theories, strain and stress gradient theories, and micromorphic theories. The nonlocal and non-classical continuum ideas can be used to study architected and metamaterials and efficient modeling of large or megastructures, by bringing material as well as structural length scales into structural theories. One of the highlights of my research with my colleague Professor Srinivasa on nonlocal models is GraFEA. It is capable of studying fracture, based on edge breakage within a classical FEA scheme, which combines the best features of FEA and bond-breakage methods in a single framework, without the user input in creating finite element meshes and, at the same time, eliminating mesh dependency.*

*Finally, coming to my observations and thoughts on roles and responsibilities as members of the mechanics community, I will begin with some observations. Mathematical models of all physical phenomena have been developed using laws of physics, experimental observations, and assumptions. There is no such thing as an "exact" mathematical model of anything we model, and we can only improve upon the existing models. Mechanics and its off-spring, computational mechanics, no matter how incomplete they are, have served humanity in predicting the response of a variety of complex phenomena to a satisfactory degree. Of course, the degree of sophistication of mathematical models can*

*change as we understand more about the process being modeled. Computational mechanics has emerged as the "third scientific methodology," in addition to the traditional two pillars of scientific inquiry, namely, mathematical and experimentation studies. The computational mechanics has also contributed to unifying ideas and bringing together diverse fields. The advances in computational mechanics also have paved ways to help both analysts and experimentalists to evaluate mathematical models and help design experiments, especially at lower spatial as well as temporal scales. Thus, mechanics of materials and computational mechanics provide an important link between materials, design, and manufacturing. Therefore, funding agencies must see this important mechanics link in going from the creation of novel materials to design and manufacturing and support the mechanics research that evaluates and certifies materials selection in the design.*

*There is some mistrust of computational methods by some of the engineering community. This is because some users are less knowledgeable of the underlying mathematical models, associated computational models, and their limitations, and develop blind faith in accepting the outcome without questioning. Many people, both researchers as well as managers (in companies or funding agencies), think that the subject of mechanics has nothing more to contribute and is taken care of by ANSYS and ABAQUS like programs. This unfortunate viewpoint has led to increased importance given to materials at the expense of mechanics and resulted in not supporting mechanics ideas by funding agencies. Consequently, many young faculty members at most research universities, aided by the undue pressure put on them to bring dollars, have resorted to areas that they consider fundable topics. Consequently, there is an erosion of "mechanics" or "science" content in some published works.*

*Now I share my thoughts on engineering education. Education is the fundamental block of the foundation to improve the quality of life. To achieve educational excellence, we must look beyond academic achievements and build a curriculum that requires a strong footing in one of the three pillars (theoretical, experimental, and computational mechanics) and adequate knowledge in the remaining two. Our engineering graduates should also have an adequate understanding of our complex technological problems. This, in turn, requires us to determine what kind of learning models should be developed. To remedy the erosion of the importance of mechanics education, our curriculum, especially at the graduate level, should not overlook the fundamental subjects like continuum mechanics and elasticity and include only more specialized subjects like multiscale modeling, nanomechanics, multifunctional materials, and so on. I believe that computational mechanics has challenged and enabled a much more basic and fundamental view of mechanics by incorporating effects that were considered impractical from a solution or analysis point of view. It has helped the mechanics community to enlarge and extend the mathematical models to include effects that are important but precluded their solution by the classical method of analysis. In the words of Professor Oden in his Timoshenko Medal acceptance speech, "A successful engineering mechanician, these days, must have a more fundamental knowledge of basic mechanics than did his (or her) predecessors." To be able to formulate a suitable mathematical model, we must take advantage of the powerful computational tools to predict realistic response and make an informed decision to help design and manufacture goods. Thus, computational mechanics has increased rather than decreased the need for rigorous mathematical studies and more fundamental mechanics understanding. Therefore computational mechanics (i.e., mechanics-based computations) should be brought early on into the curriculum.*

*Lastly, I wish to share a concern I have with what is happening at some of Tier I (research) universities. They are preoccupied with increasing their rankings in the U.S. News & World Report and likes and instituted policies that contribute to the ranking criteria. These universities have increased pressure on faculty to bring research dollars and publish. Tenure and promotions at these universities are tied to dollar amounts and number of publications, although they include teaching as one of the criteria. Young researchers faced with this pressure tend to do the minimum to get adequate student teaching evaluations (to meet the teaching part of the tenure and promotion criteria). This has a significant effect on the quality of education provided, and ultimately on the quality of the workforce for industry and*

*academia. I believe that no one should be a faculty member unless she or he is as passionate about teaching as they are about research. There is no other profession that has the same influence on young people in building their professional future and molding their character as the teaching profession. Therefore, faculty members should take interest as well as pride in teaching, without the expectation of any rewards. The pressure to publish (especially when one counts the number) also has a negative impact: it encourages publishing incremental contributions and/or contributions that have no impact (as measured by citations and inventions and patents that are used). Many young people tend to "check boxes" to get tenure or the next promotion. In the process, they are not known for any particular topic area. The only way to remedy this is when some of us get to the decision-making table insist on criteria that encourage excellence in teaching and research without using the number of dollars, which are only a means to an end.*

*I never met Professor Timoshenko in my life. Still, he lived in my works, and I promoted his legacy as a mechanician who is known for shear deformation theories of structural elements as well as a textbook writer. It is not an exaggeration if I say that his name appeared in my writings more than anyone else's, living or dead—including Timoshenko himself. Timoshenko's works bring out the importance of mathematics in explaining mechanics concepts. I enjoyed studying his books and papers, which helped me learn and contribute to the mechanics subjects he is well known for. I extended his theories to higher order and into the computational arena.*

*Although I never could fully emulate S. P. Timoshenko, I feel that I have carried his legacy forward as a researcher and textbook writer. To date, I have written 21 upper-level undergraduate and first-year and advanced graduate textbooks on a variety of topics from mechanics of materials, continuum mechanics, energy and variational methods, linear and nonlinear finite elements, composite plates and shells, to computational fluid dynamics and heat transfer. Many of them are well-received by the mechanics community and have seen 2nd, 3rd, and even the 4th editions. I consider this as important a contribution as my research works.*

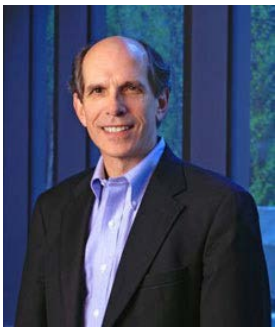
*A professional contribution that is often overlooked, or not given much recognition, is the time and effort put into mentoring young people, providing them the opportunity to learn through workshops and short courses, and research collaborations—whether they are in big or small institutions in nooks and corners of the world. I have traveled for this purpose to places where ABC (Argyris and Achenbach; Batchelor, Biot, and Budiansky; Carrier and Crandall), NBC (Needleman; Bazant; and Clifton), IRS (Irvin; Rivlin and Rice; and Southwell and Stoker), and HBO (Hutchinson and Hughes; Belytschko; and Oden) did not and could not go. I feel that this too is an important professional contribution I made.*

*Once again, I thank the Applied Mechanics Division for this prestigious award. No matter how much one deserves, it is not possible for someone to receive an award without the thoughtful consideration of the colleagues on the award committee and those who provide the support letters. I give my most sincere thanks to these unnamed colleagues. I also want to take this moment to thank my teacher and mentor, Professor Oden, and all my students and collaborators all over the world who have contributed to my professional success that enabled me to receive the Timoshenko Medal. I thank my wife for her love, support, and sacrifice throughout our married life. Finally, I thank you all for your presence tonight, and I wish you and your families the best in life."*

***J. N. Reddy***
University Distinguished Professor,
Regents Professor, and the Holder of Oscar
S. Wyatt Endowed Chair J. Mike Walker '66
Department of Mechanical Engineering,
Texas A&M University,
College Station, TX 77840

## DANIEL C. DRUCKER MEDAL — John Bassani

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.



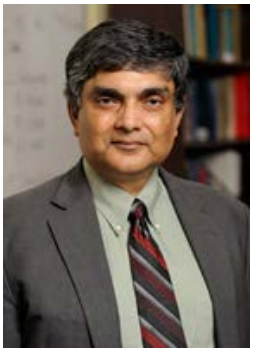
The 2019 Daniel C. Drucker Medal was awarded to ***John Bassani***, Richard H. and S. L. Gabel Professor of Mechanical Engineering and Applied Mechanics, University of Pennsylvania, "*for distinguished contributions to the mechanics of materials in the areas of dislocation mechanics, crystal plasticity, texture evolution, creep fracture, interfacial fracture, and grain boundaries, using innovative methods that link atomistic modeling, nonlinear continuum mechanics, and computational mechanics".*

## WARNER T. KOITER MEDAL — K. T. Ramesh


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 2019 Warner T. Koiter Medal was given to ***K. T. Ramesh***, Professor of Mechanical Engineering, Johns Hopkins University, "*for pioneering scientific contributions and international leadership in the area of dynamic material instabilities and material failure in diverse fields spanning the mechanics of traumatic brain injury to nanostructured materials and planetary impact".*

## TED BELYTSCHKO APPLIED MECHANICS AWARD — Somnath Ghosh



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 2019 Ted Belytschko Applied Mechanics Award was conferred upon ***Somnath Ghosh***, Michael G. Callas Chair Professor of Civil Engineering, Mechanical Engineering and Materials Science and Engineering, Johns Hopkins University, "*outstanding contributions to the field of Computational Mechanics of Materials through the development of novel methodologies in multi-scale modeling and micromechanics of heterogeneous materials, and has provided strong leadership across the disciplines".*

## THOMAS K. CAUGHEY DYNAMICS AWARD — Anil K. Bajaj, Steven W. Shaw

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 2019 Thomas K. Caughey Dynamics Award was given jointly to ***Anil K. Bajaj***, William E. and Florence E. Perry Head of Mechanical Engineering and Alpha P. Jamison Professor of Mechanical Engineering, Purdue University, and ***Steven W. Shaw***, Harris Professor of Mechanical and Civil Engineering, Florida Institute of Technology.

***Professor Bajaj*** received this recognition "*for being a world renowned scholar and educator in nonlinear dynamics, with a strong emphasis on engineering applications. Over four decades, he has advised and mentored scores of doctoral students, who are leaders in their own right now.*"

***Professor Shaw*** received this recognized *"for groundbreaking contributions to the theory and practice of nonlinear mechanical vibrations, including the discovery of invariant manifolds playing the role of nonlinear normal modes, the development of nonlinear techniques for nonsmooth oscillators, and the analysis and practical use of nonlinearities in MEMS devices."*

## THOMAS J.R. HUGHES YOUNG INVESTIGATOR AWARD — Yihui Zhang

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 2019 Thomas J.R. Hughes Young Investigator Award was given to ***Yihui Zhang***, Associate Professor of Engineering Mechanics, Tsinghua University, "for his pioneering work on the mechanics of buckling-guided 3D assembly, bio-inspired soft network materials and soft mechanical metamaterials with unusual swelling behavior."

# 2019 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 five recipients of the 2019 grants were ***Grace Gu*** (University of California at Berkeley), ***Ying Li*** (University of Connecticut), ***Xin Ning*** (Pennsylvania State University), ***Xueju Wang*** (University of Missouri), and ***Justin Wilkerson*** (Texas A&M University). The winning project titles and descriptions are provided in the following.

## Haythornthwaite Research Initiation Grant — Grace Gu

**Rational design of next-generation nanomaterials and nanomachines with atom-by-atom control:** The objective of this work is to develop a computational approach to create novel nanomaterials and nanomachines without the need of a pre-determined design. Atoms are the basic units of matter that make up the world. To meet some of civilization's greatest needs, it is crucial to have the ability to design tailored materials at the most fundamental level – the atomic scale. Here, we will integrate atomistic modeling and sensitivity analysis to generate optimal atom distributions for a material to achieve superior mechanical properties. To accelerate the design process for large systems (e.g., millions of atoms), we will develop machine learning techniques for mapping the macroscale properties of a material with its atomic structure. The structure-property relationships learned from our machine learning models can elucidate the hidden mechanisms that allow materials to have desired properties. This research direction has the potential to lead to the development of materials with unprecedented properties that are only limited by the laws of physics.

## Haythornthwaite Research Initiation Grant — *Ying Li*

**Understanding Blood Circulation and Tumor Extravasation of Nanoparticles through Fluid-Structure Interaction Simulation and 3D Tumor-on-a-chip:** Utilizing nanoparticles (NPs) to improve cancer therapy has been a promising strategy with the advantages of altering tissue biodistribution and reducing off-target effects, but still facing the challenges of limited tumor delivery due to inefficient extravasation through leaky tumor vasculature, and low tumor penetration. The objective of this project is to create a multiscale and multiphysics modeling technique for studying the vascular transport and tumor extravasation of NPs with different properties, and thereby predicting the optimal designs of NPs for enhanced accumulating within tumor sites. Specifically, the proposed research will: (1) create and validate a multiscale, multiphysics fluid-structure interaction model for predicting the vascular dynamics and extravasation of NPs exhibiting different geometrical and physiochemical features; (2) identify the optimal nanomaterial design for maximizing their extravasation at tumor site; (3) guide the experimental design of novel NPs with high efficacy and limited side effect. This study will fill the long-standing knowledge gap on the extravasation of NPs under the enhanced permeability and retention effect, and potentially offer new physical approaches to enhance the efficacy of therapeutic agents.

## Haythornthwaite Research Initiation Grant — *Xin Ning*

**Large-Scale Origami-Optoelectronics Hybrid Structures in Harsh Environments:** The objective of this proposal is to address the needs for low-weight, low-volume multifunctional structures in exploring remote destinations with harsh environments on earth and in space, such as Arctic, Antarctic, low-earth orbits, and Mars. To achieve this objective, the PI proposes to 1) develop manufacturing methods to enable large-scale multifunctional deployable structures that integrate flexible optoelectronics with hinge-free thin origami structures, and 2) to study their folding and deployment mechanics in harsh environments. The origami-optoelectronics hybrid structures can be folded and deployed, serving as not only lightweight, compact structural platforms but highly integrated systems that can survive and monitor the harsh environments.

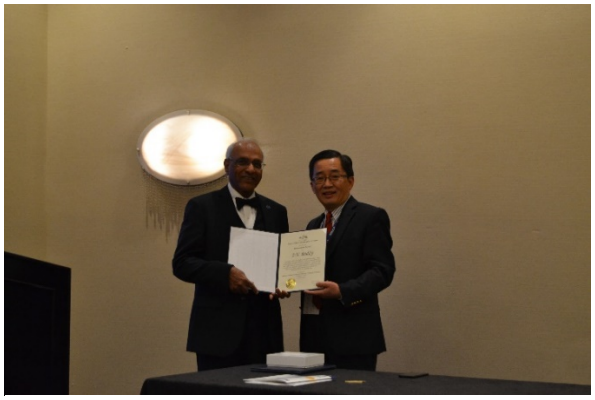
## Haythornthwaite Research Initiation Grant — *Xueju Wang*

**In Situ Investigation of the Mechanics of 3D Flexible Architectures and Electronics:** The objective of this project is to systematically investigate the mechanical robustness and compliance of 3D flexible architectures and electronics in a diversity of configurations, material compositions, and length scales through in situ mechanical testing. Complex 3D functional mesostructures are of rapidly growing interest due to their potential applications in a broad range of fields, including biomedical devices, metamaterials, electronics, and energy storage. For real applications, their mechanical robustness, with a sufficient level of mechanical compliance, under operational conditions is essentially required, such as for biomedical devices that interface with soft biology. To this end, 3D architectures and electronic devices with a diverse range of configurations will be designed and fabricated in representative types of materials (polymers, metals, etc.) through compressive buckling. The mechanical testing of the fabricated 3D structures/electronics will be performed in situ using an in-house developed setup equipped with compression/tensile testing and high-resolution imaging capabilities. In addition, the functionality of 3D electronics will be evaluated under operational conditions. Such studies will provide important guidance for the selection of materials, configurations, and material dimensions for diverse applications.

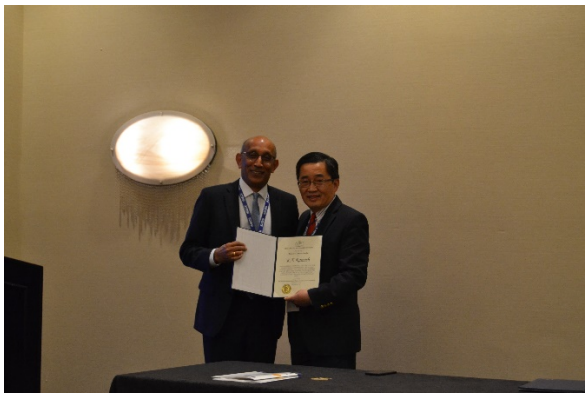
## Haythornthwaite Research Initiation Grant *Justin Wilkerson*

**A novel cavitation rheology technique (CRT) to characterize non-linear, anisotropic, and rate-dependent constitutive response of soft matter:** The objective of the proposed research is to establish a new cavitation rheology technique (CRT) as a multiscale quantitative framework for the experimental characterization and understanding of constitutive behavior, cavitation response, and damage evolution in a complete spectrum of hydrogel-like soft materials. The hydrogel-like soft materials studied will be composed of a variable mixture of polymers and solvent molecules, spanning from solid elastomers, i.e. zero solvent, at one end to pure liquid, e.g. water, at the other end. The underlying hypothesis is that the cavitation mechanisms and associated material responses are fundamentally different in solids and liquids, and as a result, the behavior may change from solid-like to liquid-like behaviors in the gels depending on the mixture, i.e. solvent concentration. Shedding light on these fundamental phenomena necessitates the use of a set of experiments spanning across several orders of length scales and strain rates relevant to each material system. Specifically, in situ experiments will be used to obtain quantitative information of the kinetics and dynamics associated with cavitation and damage response.

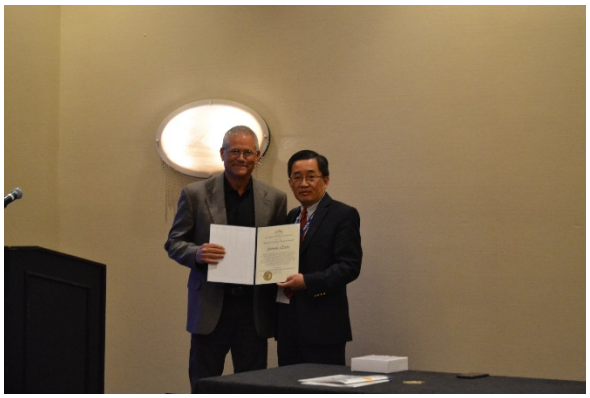
## AMD HONORS AND AWARDS BANQUET, IMECE 2019



AMD Chair Yonggang Huang presents the Timoshenko Medal to ***J.N. Reddy*** who gives his Timoshenko speech at the AMD Honors and Awards Banquet (see the transcript on page 3).

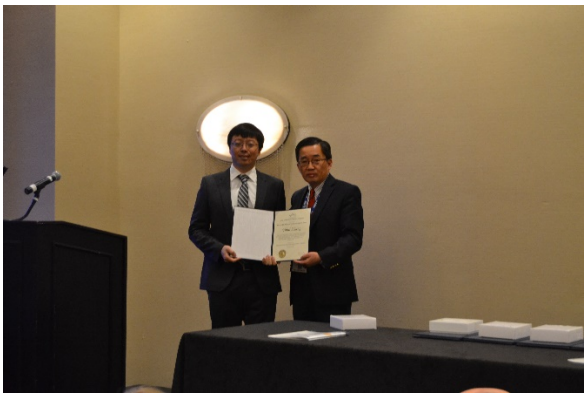


***K. T. Ramesh*** receives the Warner T. Koiter Medal *(left)*, and ***John Bassani*** receives the Daniel C. Drucker Medal *(right)* from AMD Chair Yonggang Huang.

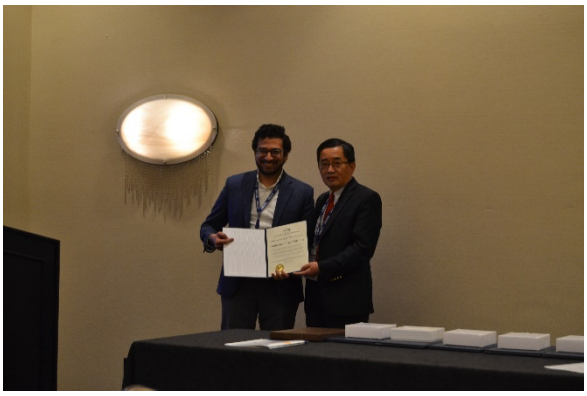
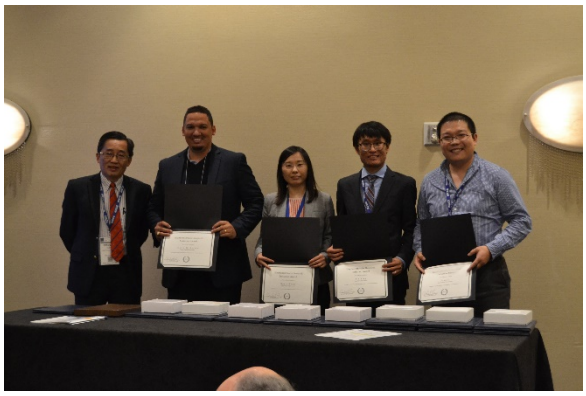



***Anil K. Bajaj*** *(left)* and ***Steven W. Shaw*** *(right)* receive the Thomas K. Caughey Dynamics Award from AMD Chair Yonggang Huang.


***Somnath Ghosh*** is the recipient of the Ted Belytschko Applied Mechanics Award [since Prof. Ghosh could not attend the event, Prof. K.T. Ramesh received the award for Prof. Ghosh (*left*)], and ***Arun R. Srinivasa*** receives the Worcester Reed Warner Medal from AMD Chair Yonggang Huang *(right)*.




***Yihui Zhang*** receives the Thomas J.R. Hughes Young Investigator Award *(left)*, and ***Xiaoyan Li*** is the recipient of the Eshelby Mechanics Award for Young Faculty *(right)*.

***Ahmed Elbanna*** receives the Journal of Applied Mechanics Award from AMD Chair Yonggang Huang *(left)*, and the recipients of the Haythornthwaite Research Initiation Grants ***Justin Wilkerson, Xueju Wang, Xin Ning,*** and ***Ying Li*** *(right,* ***Grace Gu*** not present).

## 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.

### Elasticity Technical Committee

Chair: Jianliang Xiao, University of Colorado Boulder (2018-2019)
Vice-Chair: Cunjiang Yu, University of Houston (2018-2019)
Secretary: Shuodao Wang, Oklahoma State University (2018-2019)

The AMD Elasticity Technical Committee held its annual meeting on Monday, November 11, 2019 at the Salt Lake City Marriott City Center, Salt Lake City, UT. 6 members were in attendance during the meeting. The committee approved the 2018 meeting minutes, and elected a new secretary for the TC with the term 2020-2021.

At IMECE 2019, the committee members organized 4 multidisciplinary topics:

1. *Symposium on Multiphysics Simulations and Experiments for Solids* (organizers: Dong Qian, Hanqing Jiang, and Harold Park): 4 Sections 19 talks
2. *Mechanics and Materials of Soft Electronics and Structures* (organizers: Cunjiang Yu, Jianliang Xiao, Hanqing Jiang, Jizhou Song, Shuodao Wang) – (8 presentations).
3. *Mechanics of Adhesion and Friction* (organizer: Jianliang Xiao, Chenglin Wu, Brian Bush): 1 Section 5 talks.
4. *Mechanics of Thin-Film and Multi-Layer Structures* (organizers: Shuodao Wang, Jizhou Song, Huanyu Cheng): 1 section 5 talks

The committee plans to propose and sponsor 6 topics in IMECE 2020:

1. *Symposium on Multiphysics Simulations and Experiments for Solids* (organizers: Dong Qian, Hanqing Jiang, and Harold Park)
2. *Mechanics and Materials of Soft Electronics and Structures* (organizers: Cunjiang Yu, Jianliang Xiao, Hanqing Jiang, Jizhou Song, Shuodao Wang)
3. *Mechanics of Adhesion and Friction* (organizer: Jianliang Xiao)
4. *Mechanics of Thin-Film and Multi-Layer Structures* (organizers: Shuodao Wang, Jizhou Song, Huanyu Cheng)
5. Alireza and Danial are considering to co-organize a symposium on the Elasticity related topics that involve machine learning techniques. They will look into possibility of co-sponsor the symposium with existing topic organizers.
6. Huanyu Cheng will look into possibilities of co-organizing topics related to cellular materials.

## Experimental Mechanics Technical Committee

Chair: Ryan Berke, Utah State
Vice-Chair: Owen Kingstedt, University of Utah

The Experimental Mechanics Technical Committee held the annual meeting on Tuesday, November 12, 2019, and 6 members attended the meeting.

The committee has organized a student competition in IMECE 2019, here is a summary of the competition:

1. Funding from ASME Technical Activities Council, proposals due around February
2. Awarded $5,250 to reimburse up to 15 student registration fees at $350 each
3. First/second/third place determined by judging panel: Ryan, Owen, Leslie, Natasha, and Brian
4. Permission to use any unspent funds on cash prizes for first/second/third place, but may not end up having any:
5. We had 14 participants until recently, then 2 got disqualified so we replaced them with 2 more from my lab, but 1 of the disqualifications was overturned. 14-2+2+1 = 15
6. Open question: how can we recruit participants more effectively?
7. This year: emailed the same list that we sent our call for papers, also posted on iMechanica
8. Only 4 students applied directly, plus up to 6 more from my lab. I had to invite 5 more based on abstracts to get us to 15.
9. At least 8 first-time IMECE participants, 5 women, 1 black, 1 LGBTQ+, and 2 undergrads.

In IMECE 2019, the committee organized 4 topics:

1. *Quantitative Visualization in Fracture & Fatigue* – Ryan, Natasha; Was merged into 11-18, resulting in 3 sessions (total of 15 presentations)
2. *Mechanical Characterization in Extreme Environments* – Ryan, Owen, Natasha; Was merged with 11-14, resulting in 3 sessions (total of 15 presentations)
3. *Mechanics of Adhesion and Friction* – Brian, Jianliang Xiao, Chenglin Wu; One session (total of 5 papers)
4. *In-Situ Techniques in Experimental Mechanics* – Ryan, Leslie, Owen; See 11-13, above

For IMECE 2020, the committee plans to propose/sponsor 5 topics:

1. Something generic like "*Novel Techniques in Experimental Mechanics*" or "*Advances in Experimental Mechanics*?" Would be a nice catch-all for papers that don't fit an existing category instead of dumping them all in "In-Situ Techniques."
    i. Title: "Advances in Experimental Mechanics" – Ryan, Owen, Natasha
    ii. In the abstract: include examples such as
        a. Novel Techniques
        b. In Situ Measurements
        c. Quantitative Visualization of Full-field techniques (DIC, DVC, grid methods, microscopy)
        d. High-throughput Methods
2. *Mechanical Characterization in Extreme Environments* – Ryan, Natasha; This session will be co-organized with Justin Wilkinson and Vikas Tomar in the Fracture & Fatigure Technical Committee.
3. *Mechanics of Adhesion & Friction* (ask Brian), Scott Mao (U Pitt)
4. *Time-dependent Constitutive Behavior* – Hongbing Lu (UT Dallas), Scott Mao (U Pitt)
    i. Team up with constitutive behavior committee?
    ii. Can be visco-elastic, creep, any materials
5. *Bridging Length Scales in Experimental Mechanics* (Maybe Jason – needs to confirm with his boss)

## Fracture and Failure Mechanics Technical Committee

Chair: Huck Beng Chew (University of Illinois at Urbana-Champaign)
Vice Chair: Ashfaq Adnan (University of Texas Arlington)

The Fracture and Failure Mechanics Technical Committee (FFMTC) held the annual meeting on November 11, 2019. Because of the conflicts in timing between symposiums organized by the Fracture and Failure Mechanics TC (FFMTC), many of the committee members were unable to attend the TC meeting. To summarize, the TC has come up with a number of suggestions for symposium topics for next year's IMECE meeting at Portland, Oregon. These additional topics are:

1. *Fracture and Failure of Materials under Hypersonics and Extreme Environments*
2. *Data Driven and Uncertainty Quantification Approaches to Predicting Fracture and Failure*
3. *Fracture and Failure of Bioinspired Composites*
4. *Fracture and Failure of Composite Materials*
5. *Predictive Non-Destructive Evaluation of Complex Materials and Structures*

In addition, we have confirmed the following symposiums will be re-offered again next year:

1. *Perspective on Fracture and Failure Mechanics*
2. *Dynamic Failure of Materials and Structures*
3. *Peridynamic Modeling of Materials' Behavior*

The committee was also contacting the current organizers of the below symposiums to confirm if they are interested in re-offering the same symposiums for next year's IMECE meeting:

1. *Multi-scale Mechanics of Ductile Fracture*
2. *Modeling and Experiments in Nanomechanics and Nanomaterials*
3. *Modeling of Growth, Dissolution, and Fracture*

4. *Modeling of the Fracture, Failure and Fatigue in Solids*
5. *Modeling and Testing of Molecular-level Fracture of Materials*

## Instabilities in Solids and Structures Technical Committee

Chair: Ryan S. Elliott, University of Minnesota
Vice Chairs: Stavros Gaitanaros, John Hopkins University
Kostas Danas, Ecole Polytechnique, France
Francisco Lopez Jimenez, University of Colorado, Boulder

The Instabilities in Solids and Structures Technical Committee held the annual meeting on November 12, 2019, 10 members were in attendance during the meeting.

**Background and scope of the committee:** Instabilities are important features of many of today's engineered materials and structures. Often instabilities represent failure of a material or structure, and thus it is important to identify and understand the types and behavior of instabilities that can occur in a given application area. More recently scientists and engineers have been taking advantage of the presence of instabilities in order to design materials and structures that have advantageous properties. Our Technical Committee has participated with success in the ASME Congress since 1994 and we certainly would like to keep up this tradition. Our symposiums aim to bring together top researchers interested in instability phenomena, from a broad variety of application areas within the context of solids and structures, in order to exchange knowledge and ideas on theory and experimentation in this vital and timely area of investigation.

The activities of the committee during 2019-2020:

1. The Instabilities in Solids and Structures (IiSS) Technical Committee has been very active during the 2019-2020 year. The committee is Chaired by Ryan S. Elliott of the University of Minnesota and Vice-Chaired by Stavros Gaitanaros of Johns Hopkins University. During the past year, the committee has organized sessions at the ASME-IMECE-19 in Salt Lake City, UT. Furthermore, many members of the committee were involved with and planning to participate at the 25th International Congress of Theoretical and Applied Mechanics (25th ICTAM) in Milan, Italy that was postponed to 2021 due to COVID-19.
2. At ASME-IMECE-2019, the committee organized a mini-symposium with five sessions and 25 presentations. Each of these sessions was well attended and contributed to the overall success of these events.
3. The committee is currently organizing a symposium for ASME-IMECE-2020, which is going to be held virtually, with help from Kostas Danas of CNRS, Ecole Polytechnique, France; Francisco López Jiménez of the University of Colorado Boulder; and Dai Okumura of Nagoya University, Nagoya, 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.
4. 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.

Some other topics were also discussed during the committee meeting:

1. Industry outreach - many companies interested in buckling problems, opportunities for collaborations and identifying new problems
2. IMECE-related issues

a. Try to minimize overlap between relevant symposia (especially Mechanics of Soft Materials)
b. Rooms of relevant symposia should be close to each other so that people, and especially presenters, can transfer easily in-between talks.
c. Outreach to other communities with overlapping interests (e.g. Track 3: Aerospace Technology)

## Computing in Applied Mechanics (CONCAM) Technical Committee

Chair: Caglar Oskay, Vanderbilt University
Vice Chair: Dong Qian, University of Texas at Dallas

Computing in Applied Mechanics (CONCAM) Technical Committee held the annual meeting on November 11, 2019, at the Marriott Hotel in Salt Lake City, UT. 14 members were in attendance during the meeting. The meeting was presided by Caglar Oskay, chair of the CONCAM committee, and started by a brief introduction of the participants. The committee discussed the symposia sponsored by CONCAM in IMECE 2019:

1. *Keynote Lectures on Computational Mechanics* organized by Caglar Oskay (Vanderbilt University, USA), Dong Qian (University of Texas At Dallas, USA), and Ashfaq Adnan (University of Texas at Arlington, USA).
2. *Multiphysics Simulations and Experiments for Solids* organized by Dong Qian (University of Texas At Dallas, USA), Shaofan Li (University Of California Berkeley, USA), Mark Horstemeyer (Mississippi State University, USA), Hanqing Jiang (Arizona State University, USA), Harold Park (Boston University, USA), Gang Li (Clemson University, USA), and Xianqiao Wang, University of Georgia, USA), Yingchao Yang (University of Maine, USA) and Yeqing Wang (Mississippi State University, USA).
3. *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).
4. *Mechanical Metamaterials* organized by Eduard Karpov (University of Illinois at Chicago, 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), Jaehyung Ju (Shanghai Jiao Tong University, China), Jordan Raney (University of Pennsylvania), and Jongmin Shim (University at Buffalo, 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), Mei Chandler (USACE-ERDC, USA), Jesse Sherburn (USACE-ERDC, USA), Paul Allison (University of Alabama, USA), Tonya Stone (Mississippi State University, USA), and William Lawrimore (USACE-ERDC, USA).
6. *Modeling of the Fracture, Failure and Fatigue in Solids* organized by Huijuan Zhao (Clemson University, USA), Gang Li (Clemson University, USA), Qingda Yang (University of Miami, USA), Mohsen Asle Zaeem (Colorado School of Mines, USA), Samit Roy (University of Alabama, USA), and J. B. Jordon (University of Alabama, USA).
7. *Peridynamic Modeling of Material Behavior* organized by Ibrahim Guven (Virginia

Commonwealth University, USA), Florin Bobaru (University of Nebraska-Lincoln, USA), John Foster (University of Texas at Austin, 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), H. Eliot Fang (Sandia National Laboratories, USA), Robert Taylor (University of Texas at Arlington, USA) and William Emblom (University Of Louisiana-Lafayette, USA).
9. *Computational Modeling of Extreme Events* organized by Joseph Bishop (Sandia National Laboratories, USA), J. -S. Chen (University of California, San Diego, USA) and Kent Danielson (USACE-ERDC, USA).
10. *Phase-field Modeling and Simulation in Mechanics* organized by Hector Gomez (Purdue University, USA), Michael Borden (Brigham Young University, USA) and Chad Landis (The University Of Texas At Austin, USA).

CONCAM sponsored two keynote lecture sessions on computational mechanics. This year was the second in the series. Three very good speakers were invited, Professor Somnath Ghosh from Johns Hopkins (did not come due to health reasons), Professor Philippe Geubelle from UIUC and Professor Yuri Bazilevs from Brown University. The keynotes were very well received and the committee expects that it will be continued.

The committee discussed the symposia sponsored by CONCAM in 2020. It is expected that all the sponsored symposia in 2019 will be continued. One new symposium was proposed by Professor Danial Faghihi (University of Buffalo), Professor Alireza Tabarraei (UNCC), and Dr. Kathryn Maupin (Sandia National Laboratory). The topic is "*Data-Enabled Predictive Modeling, Machine Learning, and Uncertainty Quantification in Computational Mechanics*"

CONCAM sponsored a student poster competition. This is 2nd in the series and will be held on Wednesday (11/13/2019, 12pm-2:30pm). Total 9 entries were received. 3 judges were invited (Eliot Fang from Sandia, Ashfaq Adnan from UT Arlington and Caglar Oskay from Vanderbilt). Awards will be announced concurrently with the congress-wide poster competition.

Professor Florin Bobaru has been elected new vice-chair of the committee. Professor Dong Qian will succeed as the new chair of CONCAM.

## Mechanics of Soft Materials Technical Committee

| | |
|---|---|
| Chair: | Sung Hoon Kang, Johns Hopkins University |
| Vice Chair: | Qiming Wang, University of Southern California |
| Secretary: | Victor Lefèvre, Northwestern University |
| Editor: | Yuhang Hu, Georgia Institute of Technology |

The Mechanics of Soft Materials Technical Committee held its annual meeting on Tuesday, November 12, 2019 at the Snowbird Room of the Salt Lake Marriot Downtown at City Creek in Salt Lake City, UT. 8 members were in attendance during the meeting.

At IMECE 2019, the committee members organized a symposium with ten sessions and 46 presentations, making us one of the largest symposia within the Applied Mechanics Division and across the ASME, covering the following multidisciplinary topics.

1. *Polymer Gel 1, 2*
2. *Biomechanics and Biomaterials*
3. *Liquid Crystal Elastomer*
4. *Soft Actuating Materials*
5. *Mechanics of Indentation, Injection and Cavitation*
6. *Structure and Devices*
7. *Constitutive Modeling*
8. *Aging and Damaging*
9. *Soft Matter Physics*

Each of sessions was well attended with high quality presentations. The following topics are proposed for IMECE 2020:

1. *Polymer Gel*
2. *Biomechanics and Biomaterials*
3. *Liquid Crystal Elastomer*
4. *Soft Actuating Materials*
5. *Mechanics of Indentation, Injection and Cavitation*
6. *Structure and Devices*
7. *Constitutive Modeling*
8. *Aging and Damaging*
9. *Soft Matter Physics*
10. *Biological materials*
11. *Soft Functional Composites*

We welcome members of the applied mechanics community to participate by soliciting and actively recruiting high-quality contributions to the symposia sponsored by the Mechanics of Soft Materials Committee.

## Dynamics and Control of Systems and Structures Technical Committee

Chair: Marco Amabili, McGill University
Vice Chair: Kostas Karazis, Framatome Ltd
Secretary: Dumitru I. Caruntu, University of Texas - Rio Grande Valley

The Dynamics and Control of Systems and Structures (DCSS) Technical Committee held its annual meeting on Tuesday, November 12, 2019 in the Marriott Hotel, Salt Lake City, UT.

Different from other TCs, the DCSS committee organized the entire Track 5 on Dynamics, Vibrations and Control at IMECE 2019. Dumitru Caruntu, Marco Amabili and Bogdan Epureanu were the Organizers of Track 5 Dynamics, Vibration and Control, and Ahmed Al-Jumaily the Organizer of Track 4 Biomedical and Biotechnology Engineering.

DCSS committee members organized 18 symposia totaling a number of 154 papers and 33 sessions at the ASME IMECE 2019 as follows. DCSS members Dumitru I. Caruntu, Marco Amabili, Bogdan Epureanu, and Kostas Karazis organized 6 symposia spread over 2 tracks and 11 sessions and totaling 61 papers:

1. Symposium on Dynamics and Control of Biomechanical Systems, Track 4 Biomedical and Biotechnology Engineering, Organizers: Dumitru I. Caruntu, Bogdan Epureanu,
2. Symposium on Nonlinear Dynamics, Control, and Stochastic Mechanics, Track 5 Dynamics, Vibration and Control, Organizers: Dumitru I. Caruntu, Bogdan Epureanu, and Marco Amabili,
3. Symposium on Dynamics and Control in Micro/Nano Engineering, Track 5 Dynamics, Vibration and Control, Organizers: Dumitru I. Caruntu, Bogdan Epureanu, Marco Amabili,
4. Fluid-Structure Interaction, Track 5 Dynamics, Vibration and Control, Organizers: Marco Amabili, Kostas Karazis,
5. Symposium on Vibrations of Continuous Systems, Track 5 Dynamics, Vibration and Control, Organizers: Dumitru I. Caruntu, Marco Amabili,
6. Plenary Presentations, Track 5 Dynamics, Vibration and Control, Organizers: Dumitru I. Caruntu, Bogdan Epureanu, Marco Amabili.

DCSS members also organized 12 symposia, in Track 4 and Track 5, spread over 22 sessions and totaling a number of 93 papers:

1. Biomedical and Biotechnology Plenary Presentation, Track 4 Biomedical and Biotechnology Engineering, Organizer: Ahmed Al-Jumaily
2. Symposium on Vibration and Acoustics in Biomedical Applications, Track 4, Organizer: Ahmed Al-Jumaily
3. Symposium on General Dynamics, Vibration and Control, Track 5, Organizers: Zhinbin Lin, Xiangqing Tangpong
4. Symposium on Design and Control of Robots, Mechanisms and Structures, Track 5, Organizers: Hong Zhou, Puren Ouyang
5. Symposium on Smart Structures and Structronic Systems: Sensing, Energy Generation and Control, Track 5, Organizers: Hua Li, Hornsen Tzou,
6. Symposium on Novel Control of Dynamic System and Design, Track 5, Organizers: Steve Suh, Yu Guo,
7. Symposium on Multibody Dynamic Systems and Applications, Track 5, Organizers: Shawn Duan, William Prescott, Ilie Talpasanu,
8. Symposium on Mobile Robots and Unmanned Ground Vehicles, Track 5, Organizers: Giuseppe Quaglia, Renato Vidoni, Giulio Reina,
9. Symposium on Control Theory and Applications, Track 5, Organizers: Majura Selekwa
10. Symposium on Stochastic Optimization, Uncertainty and Probability, Track 5, Organizers: Alba Sofi, Isaac Elishakoff, Giuseppe Muscolino
11. Symposium on Multi-Physics Dynamics-Control & Diagnostics-Prognostics of Structures and Devices, Track 5, Organizers: Ioannis Georgiou
12. Symposium on Renewable Energy, Structural Health Monitoring, and Distributed Structural Systems, Track 5, Organizers: Weidong Zhu, Chao Xu.

In IMECE 2020, the DCSS committee organizes the entire Track 7 on Dynamics, Vibrations and Control. Track 7 is sponsored by the Applied Mechanics Division, and the Design Engineering Division. Professor Dumitru I. Caruntu serves as Track chair of Track 7, while Professors Marco Amabili and Bogdan Epureanu of the University of Michigan are the Track co-chairs. In Track 7, 21 topics are proposed, including:

1. Plenary Presentations
2. General Dynamics, Vibration, and Control
3. Nonlinear Dynamics, Control, and Stochastic Mechanics
4. Design and Control of Robots, Mechanisms and Structures
5. Fluid-Structure Interaction
6. Dynamics and Control in Micro/Nano Engineering
7. Smart Structures and Structronic Systems: Sensing, Energy Generation and Control
8. Novel Control of Dynamic System and Design
9. Multibody Dynamic Systems and Applications
10. Vibrations of Continuous Systems
11. Mobile Robots and Unmanned Ground Vehicles
12. Control Theory and Applications
13. Optimization, Uncertainty and Probability
14. Measurement and Analysis Techniques in Nonlinear Dynamic Systems
15. Multi-Physics Dynamics-Control & Diagnostics-Prognostics of Structures and Devices
16. Renewable Energy, Structural Health Monitoring, and Distributed Structural Systems
17. Dynamics and Control of Soft Structures
18. Multi-Field Coupling and Control
19. Congress-Wide Symposium on NDE & SHM- Health Monitoring and Prognostics in Dynamic Systems
20. Machine Learning and Artificial Intelligence in Dynamics and Vibrations
21. Big Data Science & Machine Learning for Complex Structural & Material Dynamical Processes.

The committee also discussed other businesses during the TC meeting, including:

1. Liaison Report (TCVS, MNS, MSNDC, DED, AMD)
2. DCSS Award, progress and guidelines
3. ASME Fellowship nomination guidelines
   --- Marco Amabili nominated Micky Caruntu and Hong Zhou
4. Committee membership and New members
5. Election of Marco Amabili in the AMD Executive Committee

## NEWS FROM THE ASME-AMD JOURNALS

### Journal of Applied Mechanics

JAM continues to be the fastest mechanics journal in the world. It has attracted a lot of junior authors in 2019, including the 2019 Journal of Applied Mechanics Awardee Ahmed Elbanna from University of Illinois. It has also attracted many senior authors in 2019 such as Profs. Ray Baughman, Zdenek Bazant, Richard Christensen, Daining Fang, Norman Fleck, Huajian Gao, John Hutchinson, Yonggang Huang, Zhongqin Lin, Robert McMeeking, Alan Needleman, Michael Ortiz, G. Ravichandran, JN Reddy, Ares Rosakis, Xiaoting Rui, Christopher Schuh, Alexander Shapiro, Alexander Smits, Pol Spanos, Zhigang Suo, Viggo Tvergaard, Yueguang Wei, and Wei Yang."

***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 ***Shengqiang Cai*** from University of California San Diego will receive the 2020 JAM Award for his paper "Determining prestrains in an elastomer through elliptical indentation".

## 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 2020 InCites Journal Citation Reports (Clarivate Analytics, 2020) for AMR based on data from 2019 and earlier show a total of 4,433 citations in 2019, up from 4,208 citations in 2018 and 3,868 citations in 2017. In 2019, the journal's two-year impact factor was 6.733 (up from 6.138 in 2018). Its 5-year impact factor was 10.614, up from 9.655 in 2018. Top-cited papers from 2017 and 2018 contributing to the two-year impact factor were papers by Kochmann and Bertoldi on "Exploiting Microstructural Instabilities in Solids and Structures: From Metamaterials to Structural Transitions," by Ghaednia *et al* on "A Review of Elastic-Plastic Contact Mechanics" from a special AMR issue in collaboration with the ASME Journal of Tribology, and by Jacobs and Martini on "Measuring and Understanding Contact Area at the Nanoscale: A Review," from the same special issue and also the winner of the 2018 Lloyd Hamilton Donnell Applied Mechanics Reviews Paper Award. Prominent among journals citing content in Applied Mechanics Reviews in 2019 were the Journal of the Mechanics and Physics of Solids, the Journal of Fluid Mechanics, and the ASME Journal of Mechanisms and Robotics.

In 2019, Applied Mechanics Reviews published 6 issues, totaling 394 pages, including a special issue of AMR in collaboration with the ASME Journal of Computational and Nonlinear Dynamics. Recent publications include:

1. Meng and Wang, "Mechanics of Strong and Tough Cellulose Nanopaper"
2. Liang *et al*, "A Survey of Models of Ultraslow Diffusion in Heterogeneous Materials"

3. Liu *et al*, "Regulation of Cell Behavior by Hydrostatic Pressure"
4. Farazmand and Sapsis, "Extreme Events: Mechanisms and Predictions"
5. Natsiavas, "Analytic Modeling of Discrete Mechanical Systems Involving Contact, Impact, and Friction"
6. Mitra and Epureanu, "Dynamic Modeling and Projection-Based Reduction Methods for Bladed Disks With Nonlinear Frictional and Intermittent Contact Interfaces"
7. Corona *et al*, "Tensor Train Accelerated Solvers for Nonsmooth Rigid Body Dynamics"
8. Bhowmik *et al*, "First-Order Eigen-Perturbation Techniques for Real-Time Damage Detection of Vibrating Systems: Theory and Applications"
9. Ledezma-Ramírez *et al*, "Recent Advances in Shock Vibration Isolation: An Overview and Future Possibilities"
10. Chillara and Dapino, "Review of Morphing Laminated Composites"
11. Gu, Guenat, and Schiffmann, "A Review of Grooved Dynamic Gas Bearings"
12. Montanero and Ponce-Torres, "Review on the Dynamics of Isothermal Liquid Bridges"
13. Feng *et al*, "A Review on the Relationships Between Acoustic Emission, Friction and Wear in Mechanical Systems"
14. Mittelstedt, "Buckling and Post-Buckling of Thin-Walled Composite Laminated Beams—A Review of Engineering Analysis Methods"
15. Müller, "Dynamics Modeling of Topologically Simple Parallel Kinematic Manipulators: A Geometric Approach"
16. Ling *et al*, "Kinetostatics and Dynamic Modeling of Flexure-Based Compliant Mechanisms: A Survey"

Applied Mechanics Reviews was founded in 1948 under the editorship of Lloyd Hamilton Donnell. The biennial **Lloyd Hamilton Donnell Applied Mechanics Reviews Paper Award** recognizes an outstanding contribution to the applied mechanics archival literature, published in Applied Mechanics Reviews during the preceding two-year period. The 2020 award, selected from papers published between July 2018 and May 2020, will be announced in conjunction with AMD activities during the IMECE meeting in November 2020.

Applied Mechanics Reviews is served by an editorial board of Associate Editors (AEs) who collaborate with the Editor-in-Chief in soliciting invited contributions to the journal and managing the peer review process. The current editorial board consists of Arezoo Ardekani, Samantha Daly, Rui Huang, Dennis Kochmann, Michael Leamy, Martin Schanz, Gary Seidel, and Petia Vlahovska. Sergei Chernyshenko and Vicky Nguyen recently completed their terms. Nominations and self-nominations for membership on the editorial board are invited from across the community. Those that enhance the diversity of the board and its ability to promote an inclusive and accessible outlet for applied mechanics research are highly encouraged.

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***

## The Lloyd Hamilton Donnell Applied Mechanics Reviews Paper Award

Applied Mechanics Reviews was founded in 1948 under the editorship of Lloyd Hamilton Donnell. The biennial Lloyd Hamilton Donnell Applied Mechanics Reviews Paper Award recognizes an outstanding contribution to the applied mechanics archival literature, published in Applied Mechanics Reviews during the preceding two-year period. In 2020, the award was given to ***Mohammad Farazmand*** and ***Themistoklis P. Sapsis*** for their paper "Extreme Events: Mechanisms and Prediction", published in Applied Mechanics Review 71(5), in September 2019.

# OTHER ASME-AMD AWARDS

## Eshelby Mechanics Award for Young Faculty

The recipient of the 2020 Eshelby Mechanics Award for Young Faculty is Professor ***Shuman Xia*** from Georgia Tech. The award will be formally presented at the AMD Honors and Awards Banquet at IMECE 2020. 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.