



**Beginnings of the  
International Association  
for Computational  
Mechanics (IACM)**  
J. Tinsley Oden

**WCCM-ECCOMAS Congress  
will take place  
in 2021 in DIGITAL version  
January 11 to 15, 2021**  
Francisco Chinesta,  
Rémi Abgrall,  
Olivier Allix,  
Michael Kaliske  
& David Néron

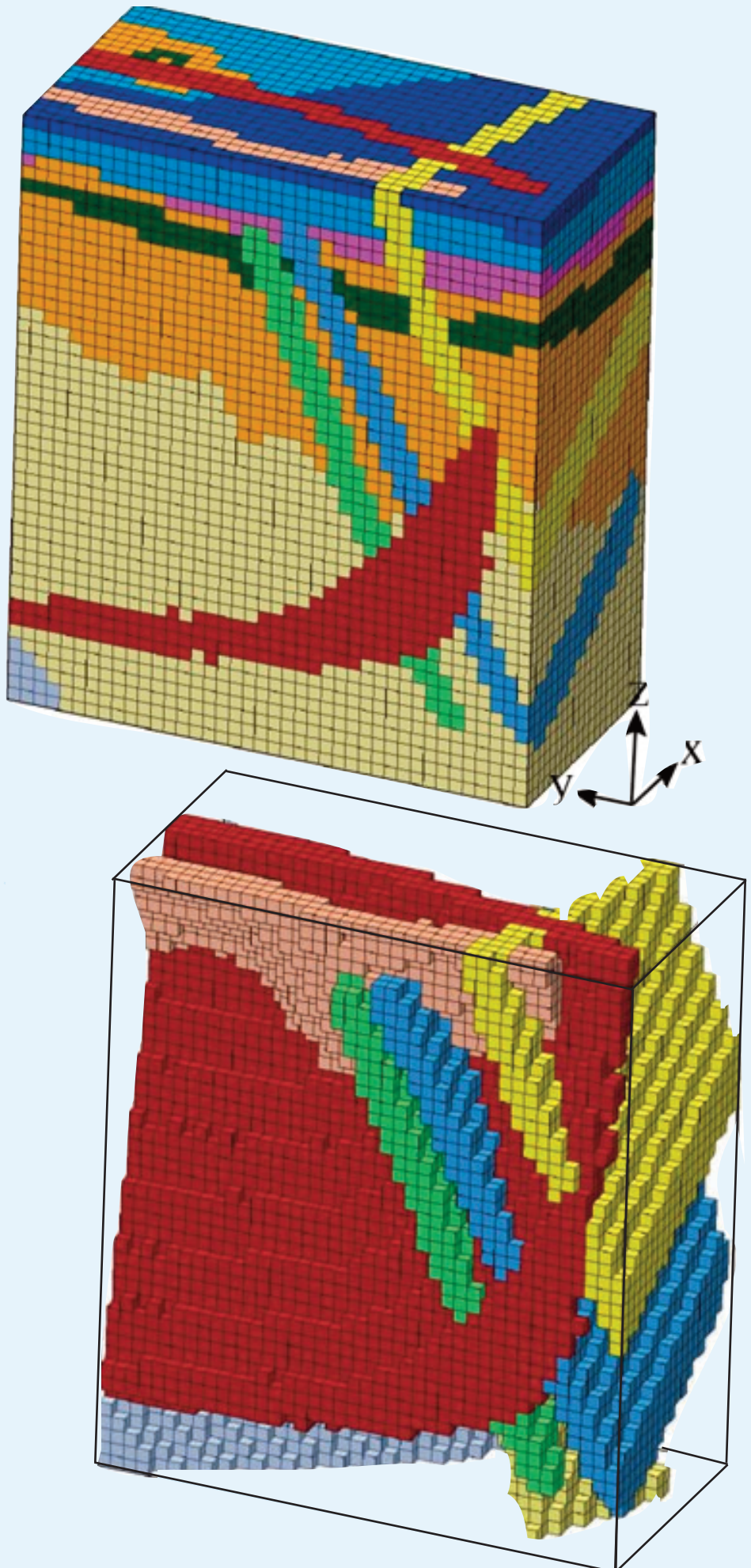
**Bits and Bugs -**  
Thomas Huckle  
Tobias Neckel  
Book Review  
by Dan Givoli

- KSCM Korea
- GIMC Italy
- USACM U.S.A.
- GACM Germany
- CSMA France
- JACM Japan
- JSCS Japan
- UKACM U.K.
- ACMT Asia Pacific
- SEMNI Spain
- ABMEC Brazil
- AMCA Argentina

**Conference Diary**

*Bulletin for  
The International Association  
for Computational Mechanics*

N° 47  
July 2020



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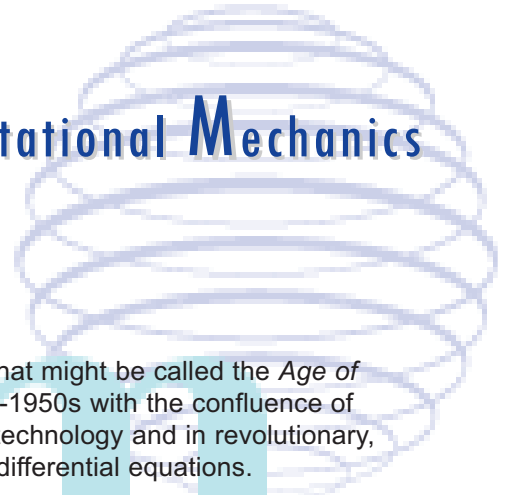
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**iaacm**



# Beginnings of the International Association for Computational Mechanics (IACM)



by  
J. Tinsley Oden

**The Age of Computational Mechanics:** What might be called the *Age of Computational Mechanics* began in the mid-1950s with the confluence of developments in digital computers, computing technology and in revolutionary, powerful numerical methods for solving partial differential equations.

These remarkable new developments gradually matured, and entered the consciousness of the members of the engineering and science communities. Many saw this period as a renaissance in applied science, providing new ways to view and resolve scientific and engineering problems in mechanics utilizing computers. Some argue that this renaissance *represented one of the greatest scientific advancements in human history*. It has certainly transformed every facet of engineering, revolutionizing engineering education and practice and has changed forever how knowledge about physical processes and engineering can be used for the benefit of mankind. The field has become a third pillar of science, standing beside empirical observations and mathematical theory as a new path toward acquiring knowledge about the behavior of physical systems.

International  
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for computational  
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Announcing  
the formation of the  
INTERNATIONAL  
ASSOCIATION FOR  
**COMPUTATIONAL  
MECHANICS**

IACM





**Postcard 1:**  
WCCM I  
Austin 1986

*“The field has become a third pillar of science, standing beside empirical observations & mathematical theory as a new path toward...”*

*What is computational mechanics?* It is the multidisciplinary, intellectual, scientific, and engineering field concerned with the use of computational methods and devices to fulfill the mission of theoretical and applied mechanics. *What is mechanics?* Most primitively, it is the study of the motion and behavior of material bodies under the action of forces. However, forces do work, so mechanics must include the study of energy and thermodynamics. Thus, the full spectrum of physical processes taking place in our universe – thermal, electromechanical, quantum, molecular – fall under the general purview of mechanics, while their study and utilization is within the province of computational mechanics. Because of its importance in modern science and technology, it is understandable that the worldwide communities involved in research and applications of computational mechanics were highly receptive to finding means to preserve, enrich, and perpetuate this field. This was the general consensus of many researchers and practitioners during the 1970s and beyond.

**The Idea and Creation of the IACM:** By the mid-1970s, it was an undeniable fact that the interdisciplinary field of computational mechanics had emerged as a driving force in engineering and applied science throughout the academic and the industrialized world.

**Postcard 2:**  
WCCM II  
Stuttgart 1990



**Postcard 3:**  
WCCM II  
Stuttgart 1990



*“ ... suggested that the time was right for organizing an international association devoted to supporting research, educating students, & facilitating collaborations...”*

Numerous companies were being created that employed the tools of computational mechanics, new journals on the subject were launched by major publishers, courses on the subject were added to the engineering curricula of many universities, and research centers were organized at several universities in different continents. Among them was a research institute at my home institution (U. Texas) which coined the term “Computational Mechanics” and launched TICOM in 1973. Other institutions developed similar research groups, such as the famous team led by Olek Zienkiewicz at Swansea, while Richard Gallagher was vigorously supporting new academic programs in the subject at the University of Arizona and later at Clarkson University, where he was President. It was within this environment that the three of us – me, the incomparable Olek Zienkiewicz, and the venerable Dick Gallagher, found ourselves in 1980 at MIT attending a conference on Finite Element Methods.

One evening during the meeting, the three of us went to dinner at a local seafood restaurant. I will never forget that Olek ordered and consumed a huge lobster dinner. It was Dick Gallagher that first suggested that the time was right for organizing an international association devoted to supporting research, educating students, and

**Postcard 4:**  
WCCM III  
Tokyo 1994





facilitating collaborations that promoted and enriched the field of computational mechanics.

The idea was that the International Association would be a federation of worldwide associations that would periodically hold a World Congress on Computational Mechanics, organize many related conferences and symposia devoted to subsets of the field, such as computational fluid mechanics, solid mechanics, electromagnetics, applied mathematics, numerical analysis, and high-performance computing. In addition, regional conferences would be held to foster collaboration with groups in Asia, Europe, the Americas, and Africa. After the MIT dinner meeting, the three of us drafted a letter to prominent university researchers, describing the general plan and calling for a meeting of those interested to formally put in place an International Association for Computational Mechanics. Such a meeting was first held at Georgia Institute of Technology in April, 1981, and it laid the groundwork for IACM, which was formally established in 1983. The First World Congress on Computational Mechanics (WCCM I) was held in Austin in 1986. In that meeting, further progress on developing the organizational plan and by-laws was made. Today IACM is a highly respected organization,



**Postcard 5:**  
WCCM IV  
Buenos Aires 1998

**Postcard 6:**  
WCCM V  
Vienna 2000





**Postcard 7:**  
WCCM VI  
Beijing 2002



*“ ... valuable framework for advancing Computational Mechanics that has uplifted, enabled, and enriched engineering and science ... ”*

looked to by all proponents of computational mechanics as the body that serves as the steward of the field which shepherds its growth and success.

**IACM Today:** Today IACM has a membership of over 5,000 and consists of 33 affiliate organizations worldwide devoted to Computational Mechanics. It has held 13 World Congresses at sites that rotate between three geographical regions: the Americas, Europe-Africa, and Asia-Australia. It has hosted numerous regional meetings and special technical conferences and it has established a prestigious list of medals and awards to recognize outstanding work in the field. I believe that the Association has been hugely successful and has provided an extremely valuable framework for advancing Computational Mechanics that has uplifted, enabled, and enriched engineering and science throughout the world.

*[I wish to thank Ruth Hengst for helping me recall dates and for typing this account. She has been my friend and colleague and a great asset to the IACM from its inception back in the 1980s. Also thanks to colleagues Tarek Zohdi, Ivo Babuska, and Tom Hughes who made constructive comments on an earlier draft.]*



**Postcard 8:**  
WCCM VII  
Los Angeles 2006



## WCCM-ECCOMAS Congress will take place in DIGITAL version from January 11 to 15, 2021

**Francisco Chinesta**  
**Rémi Abgrall**  
**Olivier Allix**  
**Michael Kaliske**  
**& David Néron**

The tragedy of the covid-19 pandemic has made impossible to organize the joint 14th World Congress in Computational Mechanics and ECCOMAS Congress in Paris in July 2020. The enthusiastic response of all the community with more than 400 mini-symposia (MS) and more than 5000 papers accepted, along with an exceptional implication of the young community, has motivated the organizers to do whatever was possible in order not to lose the work and involvement of so many scientists. This at the end led us to this digital format. The schedule is unfortunately tied, please help us to make this event the success that it deserves.

We are convinced that this new format, even with some drawbacks, has many advantages, in particular for young scientists but also for the others. For instance, it will become possible to follow all the presentations, browsing easily all the MS, surfing by keywords from one room to another and selecting only the talks that you want. The different talks will be available over a longer period than the classical one-week format. We paid special attention to maintain interaction between the participants to that purpose, direct exchanges with other participants, either by voice or by chat will be possible.

**All colleagues who already have an accepted paper** will be asked to know if they want to continue the story.

**New participants**, who are interested in joining the conference, can submit an abstract before **October 25, 2020**.

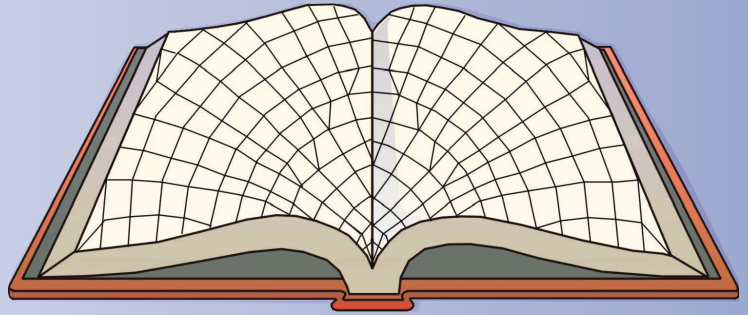
All presenters will be able to propose a **recording of their talk via a dedicated platform provided** and to participate to live discussion sessions.

*“We hope you will embrace our proposal as a means to create an enthusiastic and successful scientific event for our community. We look forward to this new experience and thank you for your understanding and support.”*



# Bits and Bugs

Thomas Huckle and Tobias Neckel  
SIAM, Philadelphia, USA, 2019



# BOOK REVIEW

**ISBN :** 978-1-611975-55-0, 251 pages, soft cover, \$44 (List Price).

**Contents:** Preface; 1: Introduction; 2: Machine Numbers, Precision, and Rounding Errors; 3: Mathematical Modeling and Discretization; 4: Design of Control Systems; 5: Synchronization and Scheduling; 6: Software-Hardware Interplay; 7: Complexity; 8: Appendix; Index.

This uniquely interesting book, published as part of the SIAM series "Software – Environments – Tools", is a collection of analyzed true stories, or case studies, on failures due to numerical bugs. The two authors are affiliated with the Institut für Informatik at the Technical University of Munich (TUM). The book is a very impressive work of collecting failure cases in scientific computing and analyzing them.

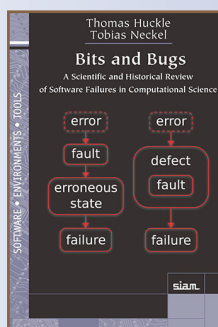
The structure of the book is well thought and highly effective. Each section, which discusses a specific case study, includes the following: (a) an amusing opening quote, often extremely relevant to the case under study; (b) a brief overview (field of application; what happened; the loss; the type of failure); (c) an introduction (the background story); (d) the timeline (a detailed description of the case); (e) a detailed description of the bug; (f) a discussion on the bug; (g) a discussion on related bugs (either other bugs in the same field of application or similar bugs in other fields); (h) bibliography. Scientific subjects that are relevant to understanding the bug are explained in inserts called "excursions". The book is scattered with many illustrations, photos and QR codes for videos related to the failures discussed. I like the preciseness of the exposition and the general appearance of the book.

When I teach a course on a computational subject, I tell the students that we will be using the words "error" and "mistake" to mean two different things (there are two separate words in Hebrew too). The error is the difference between the exact and computed solutions and is unavoidable. We wish to make the error small, but very rarely can we make it vanish. A mistake is a flaw in the algorithm, a bug, etc., and must be completely avoided. In this book, there is no distinction between the two words; the word "error" is used constantly to mean a bug, a mistake. On the other hand, the authors distinguish between a bug (fault) and a defect. On page 4 there is an amusing story about the source of the word "bug".

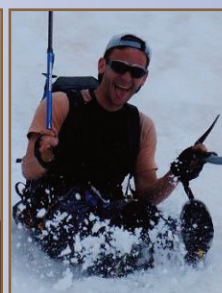
Each chapter deals with a certain type of bug or mistake. I will mention just one representative case study from each chapter, except for Chapter 3, which I will describe in more detail below. The chapter on rounding errors includes the story of the 1996 failure of the Ariane 5 launcher; the chapter on control systems includes a section on fly-by-wire; the chapter on scheduling includes a description of the Mars Pathfinder failure; the chapter on software-hardware interaction includes a section on the Pentium division bug; and the chapter on complexity includes the story about the 1990's failures in the Denver Airport.

Chapter 3, on mistakes related to mathematical modeling and discretization, would probably be the chapter most interesting to readers from the Computational Mechanics (CM) community.

It includes four case studies. The first is the loss of the Norwegian gas rig Sleipner A, due to ill judgment in the Finite Element (FE) modeling. The design of the rig was flawed due to a number of poor choices in the FE discretization process. In particular, the FE mesh (the authors use the phrase "layout of the FE grid cells") was too skewed and included low-order elements with a too high aspect ratio. This caused an underestimation of the



Thomas Huckle



Tobias Neckel

by  
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Israel Institute of  
Technology  
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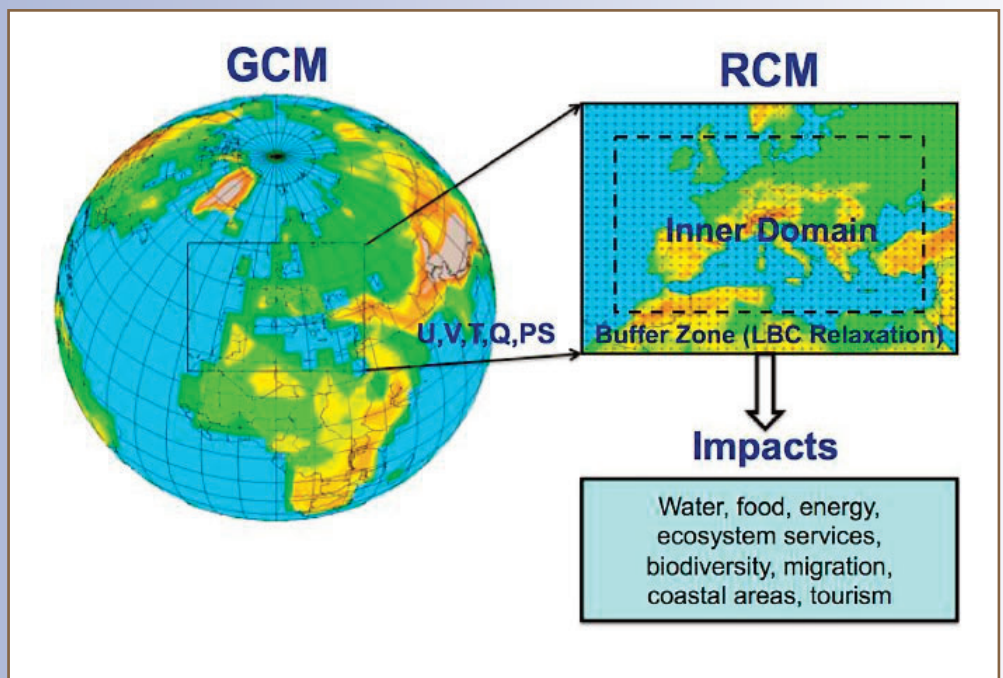
**Figure 1:**  
*The London Millennium Bridge failure, due to wrong input in the FE modeling.*  
 Left: snapshot from a YouTube movie, showing the wobbling of the bridge during its opening.  
 Right: snapshot from another YouTube movie, showing the testing of the bridge after its repair and before its reopening. Figure 3.11 in the book includes the QR codes for these two movies.

shear stresses in the structure. The anecdotes around the main story are also interesting: for example, the project engineers were well aware of the poor quality of the mesh, but decided that this would not be problematic, since in a previous case this type of mesh had been "successful". This section includes a number of "excursions" on scientific subjects: "modeling and simulation", "FE method" (with a slightly confused mixture of minimization and the weak form), "interpolation" and "extrapolation".

The second case study is that of the 2000 failure of the London Millennium Bridge. See *Figure 1*. The failure was caused by a mistake in the load input; the case of many people walking in unison on the bridge was not considered. The third case in this chapter is related to numerical weather prediction; see *Figure 2*. In particular, it discusses the underestimation of the thunderstorm Lothar in Europe in 1999. The failure was caused by two factors. First, the data assimilation procedure caused a time shift in the measurements, which the computational software was unaware of. Second, the time-step size of the global model was too large, which resulted in poor boundary conditions for the regional model. The fourth case study, entitled "mathematical finance", discusses the rapid fall of financial markets due to careless use of mathematical algorithms for high-frequency trading.

In summary, this is a highly enjoyable book, and a good read for anybody interested in scientific computing. As the authors write in the Introduction, the book can be used as a supplementary material for courses on numerical methods, it can motivate beginners in the field of scientific computing and raise the interest of the general public in the field, and "it can just entertain the interested reader". ●

**Figure 2:**  
*Computational weather prediction: the Global Climate Model (GCM) and the Regional Climate Model (RCM).*  
 This figure (not in the book) is taken by permission from F. Giorgi, "Thirty Years of Regional Climate Modeling: Where Are We and Where Are We Going next?" *J. of Geophysical Research: Atmospheres*, 124, 5696–5723, 2019

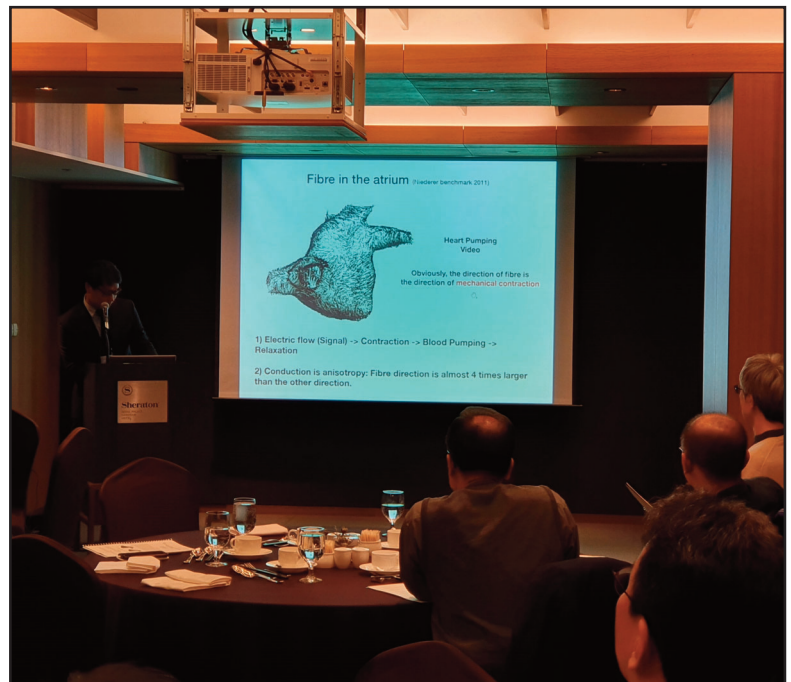


## KSCM 2019 Winter Workshop

**K**SCM 2019 Winter Workshop was held in the Four Seasons Hotel, Seoul, Korea, on 21 Nov 2019. The workshop organized by the Korean Society for Computational Mechanics aims to bring together Korean researchers in the field of computational mechanics and to encourage research exchange and networking.

Three speakers – Hyungyu Kim (Seoul National University of Science & Technology), Sehun Chun (Yonsei University) and Namwoo Kang (Sookmyung Women’s University) – gave lectures on the recent research trend in computational mechanics.

Further information will be found at: <http://www.kscm-society.org/>. ●



**Figures 1, 2 & 3:**  
*Speakers of KSCM 2019 Winter Workshop:  
Attendants and Speakers:*  
**Top Left:**  
Hyungyu Kim  
(Seoul National University of Science &  
Technology),  
**Top Right:**  
Sehun Chun  
(Yonsei University),  
and  
**Bottom Right:**  
Namwoo Kang  
(Sookmyung Women’s University)



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**News from the  
Italian Association  
of Theoretical and Applied Mechanics  
(AIMETA)**

The Italian Association of Theoretical and Applied Mechanics has renewed its committee of directors. The newly elected members are:

**Stefano Lenci** (*President*)  
**Paolo Luchini** (*Vicepresident*)  
**Sandra Carillo** (*Secretary*)  
**Carlo Casciola**  
**Walter D'Ambrogio**.  
**Fernando Fraternali**  
**Umberto Perego**

The Italian Group of Computational Mechanics (GIMC) sees a new composition, with the new appointed members:

**Stefano de Miranda**  
**Giovanni Garcea**  
**Sonia Marfia** (*Coordinator*).

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**The GIMC GMA GBMA 2020  
conference  
has been postponed to 2021**  
<http://www.gimc-gma-gbma-2020.unirc.it/>

**XXIII CONVEGNO ITALIANO MECCANICA COMPUTAZIONALE**  
**X RIUNIONE GRUPPO MATERIALI AIMETA**  
**I RIUNIONE GRUPPO DI BIOMECCANICA**

**GIMC GMA GBMA 2020**

REGGIO CALABRIA 9-12 SETTEMBRE



UNIVERSITÀ  
MEDITERRANEA  
DI REGGIO CALABRIA

**GIMC Best PhD Thesis Award**

The GIMC Best PhD Thesis Awards committee, composed by **Giuseppe Giambanco** (Università di Palermo), **Marco Donato de Tullio** (Politecnico di Bari), **Leonardo Leonetti** (Università della Calabria) and **Lorenzo Sanavia** (Università di Padova), selected the following theses, defended during the 2019 year, as the best Theses in Computational Solid and Fluid Mechanics:

- **Dr. Vito Diana**, Politecnico di Milano, "**Discrete Physically-Based Models in Solid Mechanics**". This thesis was also selected as candidate to the ECCOMAS PhD Award
- **Dr. Simone Meduri**, Politecnico di Milano, "**A fully explicit Lagrangian Finite Element Method for highly nonlinear Fluid-Structure Interaction problems**".



## Workshop on Experimental and Computational Fracture Mechanics

The Workshop on Experimental and Computational Fracture Mechanics was held February 26-28, 2020 on the campus of Louisiana State University in Baton Rouge, Louisiana. Comparison of numerical simulations against experimental data is essential for the validation of fracture models in order to gain confidence in their predictability and reliability. Peridynamics and phase field approaches have recently delivered promising results for modeling complex fracture phenomena and significant efforts have been carried out in the past years to validate the corresponding fracture models using available experimental data.

However, on one hand, it is still unclear whether the data obtained from current experiments is informative enough to satisfactorily validate models in fracture mechanics. On the other hand, it would also be interesting to combine simulation tools and experimental design to optimize control parameters in fracture mechanics experiments.

The objectives of the workshop were to bring together experts in experimental fracture mechanics, peridynamics, and phase field methods to discuss the state-of-the-art of experimental measurement and computational modeling with applications in fracture mechanics, to promote a dialogue between these communities, and to identify challenges and pathways for robust validation of phase field and peridynamic models as well as integration of experimental and modeling efforts.



**Figure 1:**  
*Louisiana Digital Media Center,  
location of the Workshop*

***This workshop was sponsored by:***

The Technical Thrust Area on Large Scale Structural Systems and Optimal Design of the US Association for Computational Mechanics,  
The Center for Computation & Technology at Louisiana State University,  
The Oak Ridge National Laboratory,  
The Society for Experimental Mechanics,  
and The U.S. National Committee on Theoretical and Applied Mechanics (USNC/TAM).

Further information on the participants and program may be found at <http://wfm2020.usacm.org>. ●

## 2020 USACM Executive Committee Election

USACM has completed the 2020 elections for members of the Executive Committee which included many qualified candidates. We are pleased to welcome the newly elected members as follows:

### **Secretary-Treasurer:**

Rekha Rao, Sandia National Laboratories.

Dr. Rao will begin her term this summer and will then rotate to Vice-President in 2022 and then to President in 2024.

### **Members-at-Large:**

There were four openings for a Member-at-Large position.

Those elected are:

John Foster, Oden Institute, University of Texas at Austin

H. Alicia Kim, University of California - San Diego

Christian Linder, Stanford University

Caglar Oskay, Vanderbilt University

The newly elected members will begin their four-year term this summer.

### **Continuing members:**

In addition to the newly elected members, the following will continue their tenure on the Executive Committee as follows:

**President:** Yuri Bazilevs, Brown University

**Vice-President:** Narayana Aluru, University of Illinois at Urbana-Champaign

### **Members-at-Large:**

Joseph Bishop, Sandia National Laboratories

Guglielmo Scovazzi, Duke University

Haim Waisman, Columbia University

Lucy Zhang, Rensselaer Polytechnic Institute

### **Directors:**

J. Tinsley Oden, Oden Institute, University of Texas at Austin

Thomas J.R. Hughes, Oden Institute, University of Texas at Austin

### **Outgoing members:**

The following will conclude their terms on the Executive Committee this summer; we are appreciative of their service to the community.

John Dolbow, Duke University (President)

Ellen Kuhl, Stanford University (Member-at-Large)

Shaofan Li, University of California, - Berkeley (Member-at-Large)

Alison Marsden, Stanford University (Member-at-Large)

Jessica Zhang, Carnegie Mellon University (Member-at-Large) ●

## *USACM Upcoming Events* *further details at [usacm.org](http://usacm.org)*

- **Meshfree and Novel Finite Elements with Applications**, September 27-29, 2020; *Berkeley, California*;  
<http://mfem2020.usacm.org>
- **Isogeometric Analysis 2020**, POSTPONED until November 6-9, 2022; *Banff, Canada*;  
<http://iga2020.usacm.org>. "Virtual IGA, **VIGA2020**, will be held August 11-12, 2020.  
Details may be found on the IGA2020 website."
- **16th National Congress on Computational Mechanics**, July 25-29, 2021; *Chicago, Illinois*;  
<http://16.usnccm.org> ●

## GACM Best PhD Awards

In 2012, GACM has successfully established an award for young academics, namely the GACM Best PhD Award. It is our great pleasure to announce that the two outstanding doctoral theses of **Dr.-Ing. Tobias Kaiser** as well as of **Dr.-Ing. Bettina Schröder** are honored with this award for the year 2019.

The thesis "**Computational modelling of non-simple and anisotropic materials**" of Tobias Kaiser was conducted at Technische Universität Dortmund and has been performed under the academic supervision of Prof. Andreas Menzel.

The thesis of Bettina Schröder titled "**Consistent Higher Order Accurate Time Discretization Methods for Inelastic Material Models**" was conducted at University of Kassel and supervised by Prof. Detlef Kuhl.

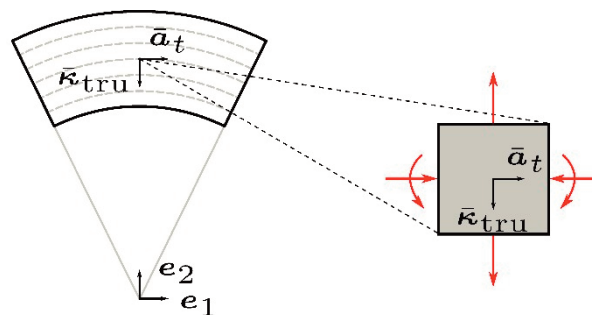


**Dr.-Ing. Tobias Kaiser:**

### **"Computational modelling of non-simple and anisotropic materials"**

In his thesis, Tobias Kaiser develops generalised continuum theories for elastically deforming nanocomposites and for localised plastic deformation processes of metals. In particular, the classic structural tensor-based modelling approach for fibre-reinforced composite materials is extended by accounting for higher-gradient contributions of the deformation map in terms of gradients of the spatial fibre direction field in the Helmholtz free energy density function. Moreover, by considering a specific combination of generalised invariants that can be interpreted in terms of the fibre-curvature, it was shown that the proposed formulation is, in principle, capable of reproducing experimentally observed size effects in nanocomposites.

With regard to plastic deformation processes in metals, a thermodynamic consistent gradient plasticity theory is proposed. The theory bases on an extended form of the Clausius-Duhem inequality by means of a non-locality residual and relies on the physical interpretation of incompatible plastic deformations in terms of dislocation density tensors.



Taking into account the kinematics of plastic deformation processes, a crystal plasticity framework is used, and localisation phenomena as well as the associated regularising properties of the proposed formulation are studied.



**Dr.-Ing. Bettina Schröder:**

### **"Consistent Higher Order Accurate Time Discretization Methods for Inelastic Material Models"**

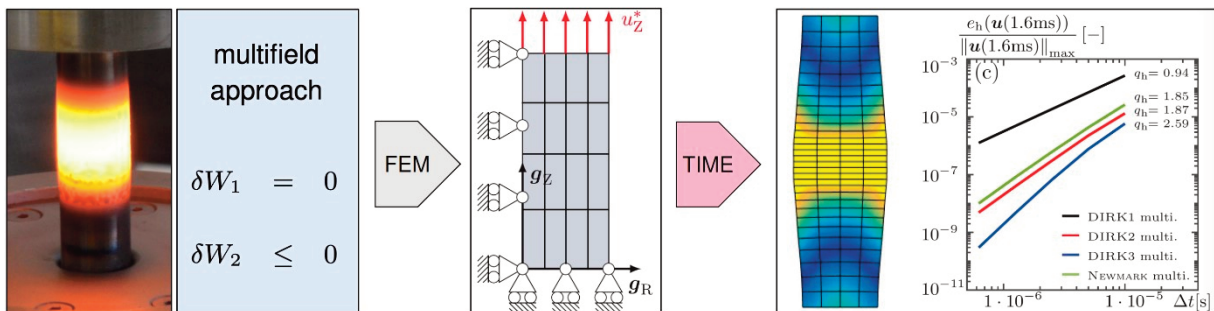
In her thesis, Bettina Schröder investigates the usage of higher order accurate time integrators together with appropriate error estimators for small and finite dynamic (visco)plasticity. Therefore, she derives a multifield formulation, adapting the principle of Jourdain. The idea is to assume that the balance of energy - taking into account a pseudopotential representing dissipative effects - resembles a rate-type functional,



whose stationarity condition leads to the equations describing small or finite dynamic (visco)- plasticity. Accordingly, the material laws and the balance of linear momentum can be solved on the same level and only one single time discretization has to be performed.

A great freedom in the choice of time integrators is obtained and the application of higher order accurate schemes - such as Newmark's method, fully implicit as well as diagonally implicit Runge-Kutta schemes, and continuous as well as discontinuous Galerkin methods - is facilitated. An analysis of this multifield formulation is accomplished by means of distinct examples where also classical approaches towards small and finite dynamic (visco)-plasticity are considered for comparison.

Additionally, a variety of time discretization error estimators are formulated and evaluated. ●



## 9<sup>th</sup> GACM Colloquium on Computational Mechanics 2021 - Essen, Germany

The 9<sup>th</sup> GACM Colloquium on Computational Mechanics for Young Scientists from Academia and Industry will take place from 25 to 27 August 2021 in Essen, Germany. The colloquium is jointly hosted by the Institute of Structural Analysis of Plates and Shells and the Institute of Mechanics at the University of Duisburg-Essen.

The GACM Colloquium is a biennial conference that brings together young researchers in the field of computational mechanics. This event provides excellent opportunities for students and postdocs to present their work, to acquire new knowledge in the field of numerical modeling in engineering and science, and to establish a network of colleagues and peers.

We would like to invite you to attend the 9<sup>th</sup> GACM Colloquium. Detailed information will be announced soon on [www.colloquia.gacm.de](http://www.colloquia.gacm.de)

*Colloquium Chairpersons:*

**D. Brands,  
H. Gravenkamp,  
C. Nisters,  
L. Scheunemann,  
A. Schwarz**

## Two GACM Related Research Training Groups by the German Research Foundation (DFG)

“Research Training Groups are established by universities to promote early career researchers. They are funded by the DFG for a period of up to nine years. Their key emphasis is on the qualification of doctoral researchers within the framework of a focused research programme and a structured training strategy.” [<http://www.dfg.de/en>]



### GRK 2423 FRASCAL: Fracture across Scales: Integrating Mechanics, Materials Science, Mathematics, Chemistry, and Physics

The Research Training Group GRK 2423 FRASCAL started in January 2019 at the Friedrich-Alexander-University Erlangen-Nuremberg and comprises eleven PhD projects and one postdoctoral project.

The aim of this interdisciplinary RTG, consisting of mechanics, materials science, mathematics, chemistry and physics, is to gain a deeper understanding of the fracture behavior of brittle, heterogeneous materials by developing simulation methods that can capture the multi-scale character of fracture processes. Although various simulation approaches describing fracture exist for particular types of materials and specific time and length scales, an integrated and overarching approach that is able to capture fracture processes in different – and in particular heterogeneous – materials at various length and time resolutions is still lacking. The projects of the RTG cover a representative spectrum of brittle materials and their composites as well as granular and porous materials. These are investigated on time and length scales relevant to the natural and engineering sciences. Modelling and simulations are based on approaches from quantum mechanics, molecular mechanics and continuum mechanics. These are embedded in a comprehensive framework leading to a virtual laboratory. The knowledge thus gained and the methodological framework allow the development of tailor-made materials that are optimized with regard to fracture behavior.

*Coordinator: Prof. Paul Steinmann, Erlangen.*  
*Homepage: <https://www.frascal.research.fau.eu/>*

### IRTG 2379: Modern Inverse Problems: From Geometry and Data to Models and Applications



The International Research Training Group 2379 “Modern Inverse Problems” was initiated by the German Research Foundation (DFG) in late 2018 and fully established in 2019.

It builds on a unique and complementary consortium, at RWTH Aachen University with its Aachen Institute of Advanced Study in Computational Engineering Science (AICES), and at the University of Texas at Austin with its Oden Institute for Computational Engineering and Sciences.

The projects are embedded in the field of modern inverse problems and introduce a new innovative perspective into the education of future scientists and engineers. They focus on the challenges that arise in the interaction of the four specific themes: geometry, data, models, and applications. IRTG MIP funds 14 doctoral positions working in 12 interdisciplinary projects. A matching number of associated doctoral students is strengthening this collaboration in both Aachen and Austin. Extensive experience with doctoral training at both partners is being perfected. Joint research training with the right combination of structure and individuality, a tailored academic program of courses and colloquia, and a common supervision concept make this transatlantic cooperation a success and a blueprint for future collaborations.

*Coordinator (RWTH): Prof. Marek Behr, Aachen,*  
*Coordinator (UT): Prof. Leszek Demkowicz, Austin.*  
*Homepage: [www.irtg-mip.rwth-aachen.de](http://www.irtg-mip.rwth-aachen.de)*





## The CSMA Prizes

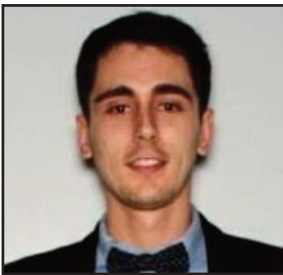
Every year CSMA rewards the best two PhD thesis of the year. For the 2019 edition, the CSMA prize committee has examined 20 applications. The two awardees are **Ruben IBAÑEZ** and **Andrei SHVARTS**. Ruben IBAÑEZ is designated as the CSMA candidate for the ECCOMAS award for the best PhD theses in 2019.

**Ruben IBAÑEZ:** *Advanced Physics-Based and Data-Driven Strategies*

**Advisors:** F. Chinesta (ENSAM), A. Huerta - Universitat Politècnica de Catalunya, E. Abisset-Chavanne (ENSAM), E. Cueto - Universid de Zaragoza, J.-L. Duval - ESI Group

Simulation Based Engineering Science (SBES) has brought major improvements in optimization, control and inverse analysis. These noticeable breakthroughs are present in a vast variety of sectors such as aeronautic, automotive industries, mobile telecommunications or healthcare. Nevertheless, SBES is currently confronting several difficulties to provide accurate results in complex industrial problems. Apart from the high computational costs associated with industrial applications, the errors introduced by constitutive modeling become more and more important when dealing with new materials. Concurrently, an unceasingly growing interest in concepts such as Big-Data, Machine Learning or Data-Analytics has been experienced. For instance, an aircraft may produce over 500 GB of data during a single flight. This panorama brings a perfect opportunity to the so-called Dynamic Data Driven Application Systems (DDDAS), whose main objective is to merge classical simulation algorithms with data coming from experimental measures in a dynamic way. Within this scenario, data and simulations would no longer be uncoupled but rather form a symbiosis. Several numerical algorithms are presented throughout this thesis whose main objective is to strengthen the link between data and computational mechanics. The first part of the work is mainly focused on parameter identification, data-driven and data completion techniques. The second part is focused on Model Order Reduction (MOR) techniques, since they constitute a fundamental ally to achieve real time constraints arising from DDDAS framework.

**Current situation:** Ruben IBAÑEZ is currently Post-doc at ENSAM Paris, France.



**Andrei SHVARTS:** *Coupling mechanical frictional contact with interfacial fluid flow at small and large scales*

**Advisors:** J. Vignollet ( Safran Tech), V. Yastrebov (MINES paristech), G. Cailletaud (MINES paristech)

This thesis deals with the problem of a thin fluid flow in narrow interfaces between contacting solids subject to a normal loading, which is relevant for a range of tribological and engineering applications, as well as for geophysical sciences. In this thesis a monolithic finite-element framework for handling frictional contact, thin incompressible viscous flow and transfer of fluid-induced tractions to the solid is developed. Additionally, we considered fluid entrapment in “pools” delimited by contact patches and formulated a novel trapped-fluid element using a non-linear compressible constitutive law. This computational framework makes use of image analysis algorithms to distinguish between contact, fluid flow and trapped fluid zones. The constructed framework is suitable for both one- and two-way coupling approaches. First, the developed framework was applied to a study of a fluid trapped between a deformable solid with a wavy surface and a rigid flat. Next, we studied a thin fluid flow between a rigid flat and a deformable solid with a model geometry or random surface roughness. We showed that for a range of physically relevant parameters, one-way coupling underestimates the interface permeability and the critical external load needed to seal the interface, compared to the two-way approach. A refined non-local phenomenological law for macroscopic permeability of rough contact interfaces was proposed. Finally, the developed framework was used to calculate the evolution of the fluid leakage through a metal-to-sapphire contact interface using an elasto-plastic material behaviour and real measurements of surface roughness.

**Current situation:** Andrei SHVARTS is currently post-doc at University of Glasgow, UK.



CSMA selected the PhD thesis of Ruben IBAÑEZ for the ECCOMAS Olympiads 2019 ●

### Report from the Japan Association for Computational Mechanics

The **JACM** is a union of researchers and engineers working in the field of computational mechanics mainly in Japan. JACM is a loosely coupled umbrella organization covering 29 computational mechanics related societies in Japan through communication with e-mail and web page (<https://ja-cm.org/index-e.html>). The number of individual members is about 350. **JACM** members actively participate in the IACM activities.

The 2019 JACM Annual Meeting was held on the occasion of APCOM 2019 (the Asian Pacific Congress on Computational Mechanics) held in the Taipei International Convention Center, Taipei, Taiwan. The JACM meetings have been held on the occasions of WCCM (World Congress on Computational Mechanics), USNCCM (US National Congress on Computational Mechanics) and APCOM.

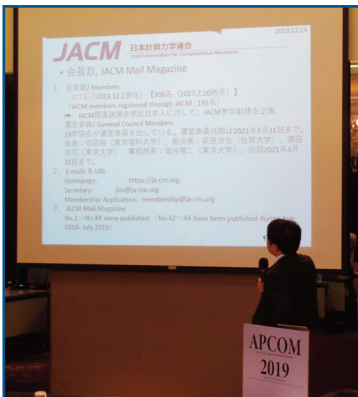
The meeting started at 12:30 on Thursday December 19. **Hiroshi Okada**, President, JACM reported the past activities of JACM. 49 members participated the meeting. Then, the award ceremony took place. The report includes the present number of members (about 330), executive members, affiliated societies, etc. (Figure 1)

Then, the award ceremony followed.

The JACM Computational Mechanics Awards were awarded to Professors **Hiroshi Okuda** (UTokyo), **Makoto Yamamoto** (Tokyo Univ. Science) and **Makoto Ohsaki** (Kyoto Univ.).

The JACM Fellows Awards and the JACM Young Investigator Awards flowed. The JACM Fellows Awards were given to Professor **Koji Fukagata** (Keio Univ.) **Yoshiaki Tamura** (Toyo Univ.), **Daisuke Ishihara** (Kyushu Inst. Tech.) and **Daisuke Tagami** (Kyushu Univ.).

The JACM Young Investigator Awards were awarded to Professors **Akinori Yamanaka** (Tokyo Univ. of Agri. and Tech.), **Hikaru Aono** (Tokyo Univ. Science) and Prof. **Shin-ichiro Sugimoto** (Hachinohe Inst. Tech.). After the ceremony, the award winners gave short speeches. The JACM meeting ended with a photo session (Figure 2).



**Figure 1:**  
2019 JACM annual meeting  
(H. Okada, President, was reporting the recent activities and status of JACM)



**Figure 2:**  
A photo of the  
2019 JACM Award  
recipients and the  
JACM executive members



On Tuesday, December 11, 2019, JACM took a part of the ninth Computational Mechanics Symposium. The symposium is organized by the **Science Council of Japan (SCJ)** in association with eight computational mechanics related academic societies in Japan. The function of **SCJ** is defined as:

*“The Science Council of Japan was established in 1949 as a “special organization” under the justification of the Prime Minister, operating independently of the government for the purpose of promoting and enhancing the field of science, and having science reflected in and permeated in administration, industries and people’s lives. It represents Japan’s scientists both domestically and internationally ...”* <<http://www.scj.go.jp/en/scj/index.html>>.

In the ninth symposium, Professors **Seiichi Koshizuka** (UTokyo) and **Kenjiro Terada** (Tohoku Univ.) served as the general chairs. After the opening remark by Professor **Shinobu Yoshimura** of University of Tokyo, eight young researchers representing participating computational mechanics related societies presented their latest research accomplishments. Majority of them were the recent award recipients of the participating societies. Professor **Hikaru Aono** (Tokyo Univ. Science) was the recipient of the 2019 JACM Young Investigator Award. He represented JACM and gave a presentation on the computational fluid dynamics simulations of flapping wings and data mining (*Figure 3*). Besides the presentations by the young researchers, three senior researchers (Professors **Kumiko Tanaka** (UTokyo), **Kokichi Sugihara** (Meiji Univ.) and **Tamotsu Murakami** (UTokyo)) gave talks on mathematical informatics of language, three-dimensional optical illusion and design idea generation. (*Figure 4*)

From December 8 through 11, 2020, **COMPSAFE 2020** (the 3rd International Conference on Computational Engineering and Science for Safety and Environmental Problems, an APACM Thematic Conference and an IACM Special Interest Conference <<https://compsafe2020.org/>>) will be held as an online conference.

The conference will be jointly hosted by JACM (Japan Association for Computational Mechanics) and JSCES (Japan Society for Computational Engineering and Science). Both organizations are IACM affiliated associations. ●



**Figure 3:**  
Professor H. Aono  
during his presentation



**Figure 4:**  
Speakers, representatives of participating societies and committee members  
of the ninth computational mechanics symposium

## Award Winners for JSCES Prizes

The JSCES prizes were presented to those researchers and practitioners who have marked outstanding achievements and contributions to the field of computational mechanics.

This year's recipients were: **Mr. Hitoshi Nakamura** (Nuclear Regulation Authority, *Figure 1*) for the JSCES Achievements Award, **Prof. Yoshitaka Wada** (Kindai University, *Figure 2*) for the Kawai Medal, **Dr. Masakazu Takagaki** (Railway Technical Research Institute, *Figure 3*) for the Shoji Medal and **Prof. Hiroyuki Tosaka** (the University of Tokyo, *Figure 4*) for the Technology Prize.

Paper awards associated with the Transaction of the JSCES (see, <https://www.jstage.jst.go.jp/browse/jscs>) were also given to the following researchers: **Mr. Makoto Tsukino** (Quint Corporation, *Figure 5*) for the Outstanding Paper Award, **Mr. Takayuki Nishino** (Showa Denko K.K., *Figure 6*), **Prof. Junji Kato** (Nagoya University, *Figure 7*) and **Prof. Takashi Kyoya** (Tohoku University, *Figure 8*) for the Outstanding Paper Award, **Dr. Kenta Sato** (the University of Tokyo, *Figure 9*) for the Young Researcher Paper Award. Moreover, **Dr. Hideyuki Sakurai** (Shimizu Corporation, *Figure 10*) and **Prof. Shinobu Yoshimura** (the University of Tokyo, *Figure 11*) were awarded as fellow members, and **Dr. Takashi Kuraishi** (Waseda University, *Figure 12*) was awarded for his outstanding Ph.D. dissertation. ●



**Figure 1:**  
Mr. Hitoshi  
Nakamura



**Figure 2:**  
Prof. Yoshitaka  
Wada



**Figure 3:**  
Dr. Masakazu  
Takagaki



**Figure 4:**  
Prof. Hiroyuki  
Tosaka



**Figure 5:**  
Mr. Makoto  
Tsukino



**Figure 6:**  
Mr. Takayuki  
Nishino



**Figure 7:**  
Prof. Junji Kato



**Figure 8:**  
Prof. Takashi  
Kyoya



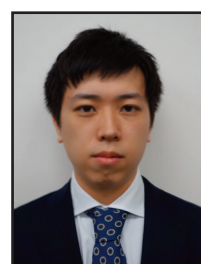
**Figure 9:**  
Dr. Kenta Sato



**Figure 10:**  
Dr. Hideyuki  
Sakurai



**Figure 11:**  
Prof. Shinobu  
Yoshimura



**Figure 12:**  
Dr. Takashi  
Kuraishi

## The JSCES Grand Prize 2019

**Prof. Antonio Huerta** (*Figure 13*) of Universitat Politècnica de Catalunya received this year's JSCES Grand Prize for his outstanding contributions in the field of computational engineering and sciences.

The awarding ceremony and his special lecture are postponed due to COVID-19 and will be held during the annual conference 2021. ●



**Figure 13:**  
Prof. Antonio Huerta



## Workshop on research perspectives of uncertainty modeling in natural disaster simulations

Workshop on research perspectives of uncertainty modeling in natural disaster simulations was held on **December 27, 2019**, at International Research Institute of Disaster Science (IRiDeS), Tohoku University. The workshop was organized by two study groups in JSCES: study group on uncertainty modeling and simulation and study group on hyper complex disaster simulation.

This workshop was aimed at discussing the latest outcomes and future perspectives of uncertainty modeling in natural disaster simulations. The lecturers, **Dr. Mayuko Nishio** (University of Tsukuba), **Dr. Mao Kurumatani** (Ibaraki University), **Dr. Shinya Yamamoto** (Shimizu Corporation), and **Dr. Daigoro Isobe** (University of Tsukuba), delivered lively lectures (Figures 14, 15, and 16).

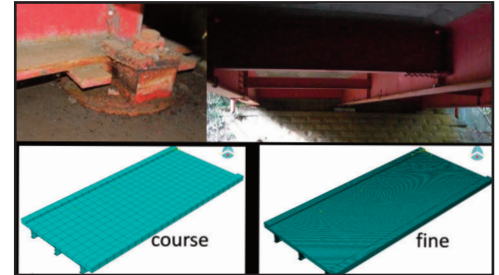
After the lectures, discussion was held among the participants and lecturers to share important knowledge and concepts for uncertainty modeling. ●

by: Shuji Moriguchi

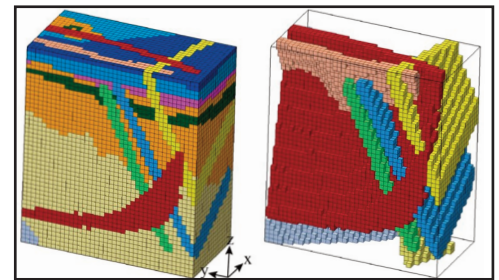
**Figure 15:**  
Variation of crack propagation in a concrete beam test (Dr. Mao Kurumatani)



**Figure 14:**  
FE modeling of an aging bridge for UQ (uncertainty quantification) (Dr. Mayuko Nishio)



**Figure 16:**  
Geological structure used in calibration of a groundwater flow model (Dr. Shinya Yamamoto)



## COMPSAFE2020



The 3rd International Conference on Computational Engineering and Science for Safety and Environmental Problems (COMPSAFE2020), which was first scheduled to be held in March 2020, is postponed to **December 8-11, 2020**, due to the pandemic of COVID-19. **This conference will be held fully online.** The registration fees for participants are all uniformly set to 30,000 JPY.

This conference series is an APACM Thematic Conference and an IACM Special Interest Conference, aimed to connect researchers and scientists from all over the world on-line, who fight daily in the field of disaster prevention and mitigation, structural and material failure, safety and security maintenance, and so on.

### The new important dates of the conference are:

Deadline for abstracts submission	July 17, 2020
Notification of acceptance	August 31, 2020
Online submission of extended abstracts opens (optional)	September 1, 2020
Deadline for early registration	September 15, 2020
Deadline for extended abstracts submission (optional)	October 16, 2020
Deadline for registration	October 16, 2020
Conference dates	December 8-11, 2020

Conference venue: ONLINE

Secretary email: [secretary@compsafe2020.org](mailto:secretary@compsafe2020.org)

Please check: <http://www.compsafe2020.org/> for further information. ●

**UKACM response to  
COVID-19 crisis**


The effect of the COVID-19 has been profound at all levels of society around the world and UKACM has not been an exception. The UKACM 2020 conference was planned to take place on April 1-3, 2020 in Loughborough University. The UKACM Executive Committee considered that it was not safe to go ahead with the conference and, with regret, decided to cancel the event.

The principal activity of UKACM is the organisation of the annual conference, aiming to provide a platform for UK PhD students and post-doctoral researchers to showcase their research. To continue supporting the young generation of UK researchers in computational mechanics, UKACM has decided to organise a Research Highlight Competition to provide a platform for the young generation of UK researchers in computational mechanics to showcase their research.

Participants are asked to submit one slide and a video (maximum 3 minutes) explaining the slide. A committee formed by members of UKACM will select three winners that will receive a diploma from UKACM and a monetary prize

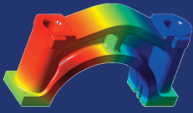
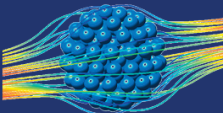
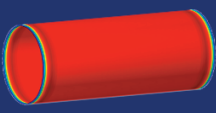
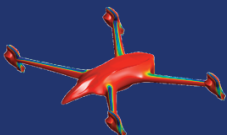
- Mike Crisfield Prize for the best presentation (£250)
- Best Post-doctoral researcher (£100)
- Best Post-graduate Research Student (£100)

Eligible participants are PhD students and post-doctoral researchers affiliated to a UK institution represented in the Board of UKACM (<http://ukacm.org/ukacm-board/>).



## Research highlight competition

- Prepare 1 slide showcasing your research in the field of computational mechanics
- Record a video (maximum 3 minutes) explaining the slide
- Submit the slide and the video for the chance to win one of the three prizes

Use the slide template in <https://ukacm.org/downloads> (submit as JPG, JPEG or PNG)

Use your preferred software to record the video (submit as MPG, MPEG, AVI or MP4)

Submit to UKACM: [research@ukacm.org](mailto:research@ukacm.org) Deadline: 15<sup>th</sup> May 2020, 5pm

In addition, the Executive Committee of UKACM has decided that the next conference will take place in Loughborough University.

The ASCE engineering mechanics institute international conference planned for April 5-8, 2020 and sponsored by UKACM was also cancelled due to the COVID-19 crisis. The conference will be organised in Durham in 2021 and will have the support of UKACM.

In 2020, UKACM was planning to host the first meeting between the UK and the Chinese Associations for Computational Mechanics. The event, planned for the week after the World Congress in Paris, has also been postponed due to the COVID-19 crisis. ●



### **Professor Roger Owen, FRS**

It is with great sadness that UKACM informs that Roger Owen passed away on Monday 13th January 2020. Roger was a recognised world leading authority in the field of Computational Mechanics and an inspiring person that has led so many of us to be willing to come to Swansea to develop our careers. He made leading scientific contributions to the fields of computational plasticity, finite element and discrete element methods. In addition to being elected Fellow of the Royal Society, he was the recipient of many honours, including being elected Foreign Member of the US National Academy of Engineering and the Chinese Academy of Sciences. In recognition for his contribution, leadership and impact, he received Honorary Doctorates from world leading institutions, including UPC in Barcelona, University of Cape Town, University of Porto and others.

Roger also was a co-founder of Rockfield Software Ltd, which specialises in finite/discrete element software. The company received two Queen's Award for Innovation in 2002 and 2007. His dedication to the field has been admirable, being part of both the UKACM and IACM for many years.

Roger's remarkable good humour and ability to socialise with colleagues will certainly be missed by the whole community.

Roger will be sorely missed but forever remembered!

In his honour, the Executive Committee of UKACM decided to name the prize of the best UK PhD thesis in computational mechanics after Roger Owen. ●



### **Professor Peter Bettess**

It is with great sadness that UKACM, have to informs that Peter Bettess passed away at his home in the Lake District at the age of 74.

Prof Bettess obtained his BSc in Civil Engineering and MSc in Structural Engineering from Imperial College. He then moved to Durham to complete his PhD in the Department of Engineering Science.

After spending some time working for the British Ship Research Association, he became a lecturer in the Department of Civil Engineering at Swansea, in 1971, where he worked with Professor Olek Zienkiewicz. In 1986 he became the Lloyd's Register Professor of Offshore Engineering at the University of Newcastle upon Tyne. In 1995 he moved back to Durham, where he continued his teaching and research activities until his retirement in 2004.

Many of you will be familiar with one of the most well-known contributions by Peter, the infinite elements.

Peter will be sorely missed by the whole community. ●



**The 7th Asia-Pacific Congress on Computational Mechanics  
(APCOM 2019)**

*Hosted by:*  
**Association of Computational Mechanics Taiwan  
(ACMT)**

The APACM used as a shorthand for Asian-Pacific Association of Computational Mechanics since its formation in 1999 comprises of the national and regional associations for computational mechanics in the Asia-Australia Region. The APACM is one of the three continental associations affiliated with the International Association of Computational Mechanics (IACM). To promote the computational mechanics activities within the designated region, the APACM organizes the Asian Pacific Congress on Computational Mechanics (APCOM) in different countries of the region at an interval of three years. The following is a historical count of the venues for the APCOM: Sydney (2001), Beijing (2004), Sydney (2007), Sydney (2010), Singapore (2013), and Seoul (2016). The APCOM 2019 held in Taipei is the 7th meeting in the series.

**Conference Organisers:**



**YB Yang**  
*ybyang@ntu.edu.tw*  
Chairman  
President, APACM,  
ACMT



**CA Lin**  
*calin@pme.nthu.edu.tw*  
Co-Chairman  
Vice President, ACMT



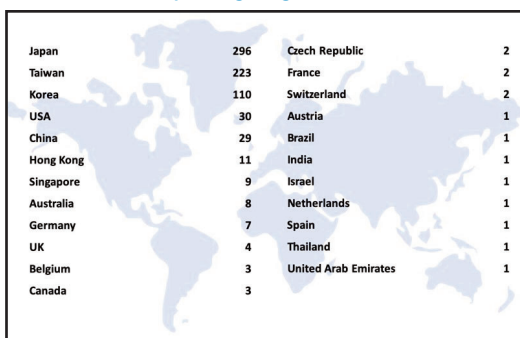
**LJ Leu**  
*ljleu@ntu.edu.tw*  
Co-Chairman  
Executive Council  
Member, ACMT



**CS David Chen**  
*dchen@ntu.edu.tw*  
Co-Chairman/Secretary  
General, Secretary  
General, ACMT

APCOM 2019 aims to provide a platform for researchers and practitioners to discuss and share the latest findings and developments in all aspects of computational mechanics. A total number of 747 participants from 29 countries and regions came and celebrated the three-day event. We are honored to have several world-leading scholars to deliver the 8 plenary and 16 semi-plenary lectures, including Prof. Herbert Mang (Former President of Austrian Academy of Sciences), Prof. Wing-Kam Liu (Former President of IACM), Prof. David J. Srolovitz (Member of US National Academy of Engineering), Prof. Antonio Huerta (President of IACM), Prof. J.S. Chen (Former President of US Association of Computational Mechanics), Prof. Gui-Rong Liu (Former President of APACM), etc.

**Figure 1:**  
*Participating regions*



APCOM 2019 featured 67 minisymposia, 96 session keynote lectures, and 544 oral presentations. There were 147 sessions for topics of methods and applications related to various aspects of computational mechanics and interdisciplinary topics, including, bio-medical applications, materials modeling, fluid-structure interaction, materials genome, etc. We also took this opportunity to host APACM executive council and general council meetings, JACM meeting, and ACMT executive council and general council meeting. Most of the members are long-time old friends and all enjoyed this opportunity to greet and share the latest excitement with each other.





**Figure 3:**  
APACM Executive Council Meeting



**Figure 4:**  
APACM General Council Meeting



**Figure 5:**  
APACM Award Ceremony

A special feature of this conference is the dedication of 3 minisymposia to the celebration of Prof. Genki Yagawa for his 77th birthday, and to Prof. Shinobu Yoshimura and Kazuo Kashiya for their 60th Birthday. This adds to the technical atmosphere some soft, touching elements of friendship.

APCOM 2019 was a great success. We appreciate the support of plenary and semi-plenary speakers, keynote speakers, the minisymposia organizers and strong involvement of the participants. ●

**Figure 6:**  
Opening Plenary Lecture by Prof. Herbert Mang



**Figure 7:**  
Opening Plenary Lecture by Prof. Wing-Kam Liu



**Figure 8:**  
Appreciation Dinner for Minisymposia Organizers



**Figure 9:**  
Birthday Celebration Party for Prof. Genki Yagawa and Prof. Shinobu Yoshimura at Taipei 101



## Meeting of the SEMNI Executive Board

**Figure 1:**

From left to right, profs. P. Díez, X. Oliver, R. Rossi, M. Casteleiro, R. Yu, E. Cueto, I. Arias, E. Oñate, J. Baiges, J. J. Ródenas, I. Romero, F. Montáns, A. Huerta (IACM president) and F. Navarrina

Last February 2nd, the SEMNI executive board meeting took place at the School of Civil Engineering of the Technical University of Catalonia, UPC. Among other issues, the board decided on the annual Ph.D. thesis prize. This year, Dr. Rubén Ibáñez, who earned double-degree diploma under the advice of Profs. Chinesta at ENSAM Institute of Technology, and prof. Antonio Huerta, at UPC BarcelonaTech, was awarded the prize. Congratulations, Rubén! ●



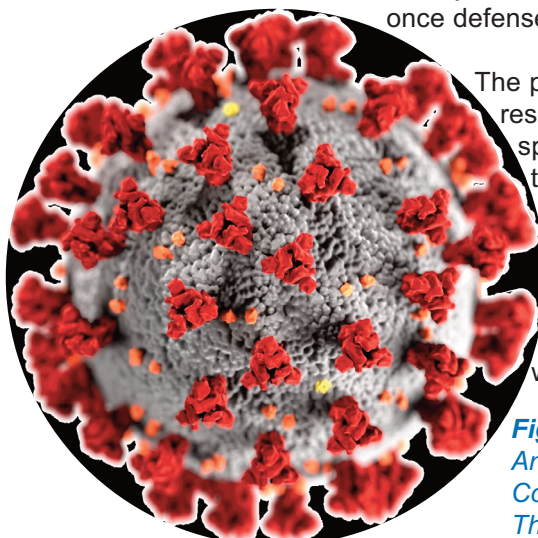
**Figure 2:**

Prof. Fermín Navarrina, principal investigator of the Project

## What computational mechanics has to say about coronavirus

It may appear that our community has little to say about a crisis such as the COVID-19. However, you may be surprised to know that structural and computational mechanics may play a fundamental role in beating SARS-CoV 2. An international consortium of IACM and SEMNI researchers has been granted a project by the Carlos III Spanish National Health Institute. The team, coordinated by Prof. Fermín Navarrina at the University of Coruña, Spain, is also composed by labs of the Universities of Vienna, Michigan and Purdue.

The main goal of the project is to destroy viruses by destroying their virion's capsid. The capsid is the protein shell of the virus, enclosing the genetic material. Once destroyed, the genetic material will lose its ability to introduce itself in the cells and, once defenseless, will degrade.



The project will conduct a structural dynamics study in order to unveil the resonance frequencies of the capsid. This will be done by developing specific numerical strategies that, once completed, will allow identifying these frequencies.

Once the structural behavior of the virus is identified, viruses could be destroyed by employing ultrasound techniques, for instance. The consortium hopes the prototype of such a machine to be ready in a "relatively short" period of time and, perhaps more importantly, with affordable cost.. ●

**Figure 3:**

An image of the SARS CoV 2 virus, courtesy of the Centers for Disease Control and Prevention. In red, the spikes of the virion. The capsid is represented in grey



# XLI CILAMCE



XLI Ibero-Latin American Congress on Computational Methods in Engineering

**16-19 November, 2020** **FOZ DO IGUAÇU  
PARANÁ – BRAZIL**

The XLI Ibero-Latin American Congress on Computational Methods in Engineering (**CILAMCE 2020**) will take place in the amazing venue of **Foz do Iguaçu, Paraná, Brazil, from 16 to 19 November 2020**. CILAMCE is an annual conference promoted by the **Brazilian Association of Computational Methods in Engineering (ABMEC)**, intended to serve as an international forum for communicating latest developments on numerical methods in all fields of engineering and related sciences.

Since its inception in 1977 by the then emerging Brazilian community of computational mechanics, CILAMCE has become the main scientific conference for researchers, graduate students, engineers and other professionals from Brazil and Ibero-Latin America (and even from further abroad) to discuss and explore the state-of-the-art on computational methods in engineering.

The technical program typically includes worldly prominent plenary speakers, together with several mini-symposia parallel sessions with contributed papers. CILAMCE also promotes a special student competition – the Agustin Ferrante Award – to acknowledge undergraduate students who show potential for outstanding scientific achievements.

*THE DEADLINE FOR ABSTRACT SUBMISSION TO CILAMCE-2020 IS **JULY 1, 2020**.*

We are looking forward to welcoming you to Foz do Iguaçu for the CILAMCE 2020 next November!

*Warmest regards,*

Prof. Eduardo M. B. Campello (ABMEC, President)

Prof. Felício B. Barros (ABMEC, Vice-President)

Prof. Aref K. Kazam (Chairman of CILAMCE-2020)

Prof. Andre J. Torii (Co-Chairman of CILAMCE-2020).

[www.cilamce.com.br](http://www.cilamce.com.br)





**LAMEC**  
**Computational Mechanics Laboratory**  
**Resistencia, Chaco, Argentina**

The Computational Mechanics Laboratory (LAMEC) is a research group dedicated to the implementation and development of computational methods in science and engineering. It also performs technical assistance to the industry on problems related to several fields of computational mechanics. LAMEC depends on both the Faculty of Engineering of the National University of the NorthEast (UNNE) and the National Scientific and Technical Research Council – Argentina - (CONICET) through the Institute of Modeling and Technological Innovation (IMIT).

LAMEC was created in July 2018 as an initiative of the Faculty of Engineering (UNNE) authorities to lay the foundations of a research group dedicated to the study of new topics that until then were not addressed by the local scientific community.

**Figure 1:**  
 LAMEC Staff  
 (2019 photograph)



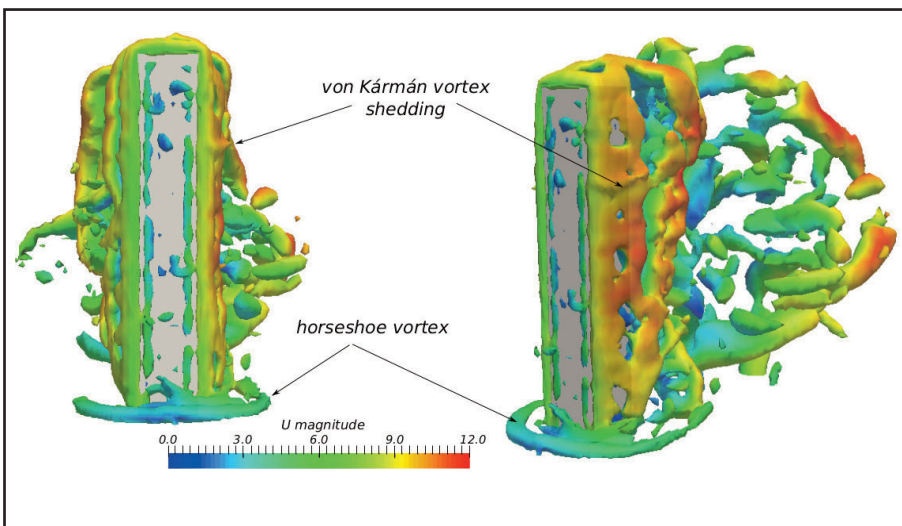
The research group is composed by faculty and research partners from across the Faculty of Engineering, as well as members of IMIT and CONICET involved in education and research in computational engineering. In this way, LAMEC currently has nine Researchers from CONICET and the Faculty of Engineering, five PhD students and several undergraduate students.

LAMEC also provides support for master and doctoral programs in engineering at UNNE, by teaching several courses and guiding students through their thesis work, (Figure 1).

The areas of research include:

- *Computational Fluid Dynamics (CFD)*. Fundamental research in fluid mechanics and turbulence: external aerodynamic performance of ground vehicles, turbulence synthesis, tall buildings aerodynamics, pollutant dispersion (Figure 2), flow through porous media in general.

**Figure 2:**  
 CFD applied to a tall building  
 aerodynamics study

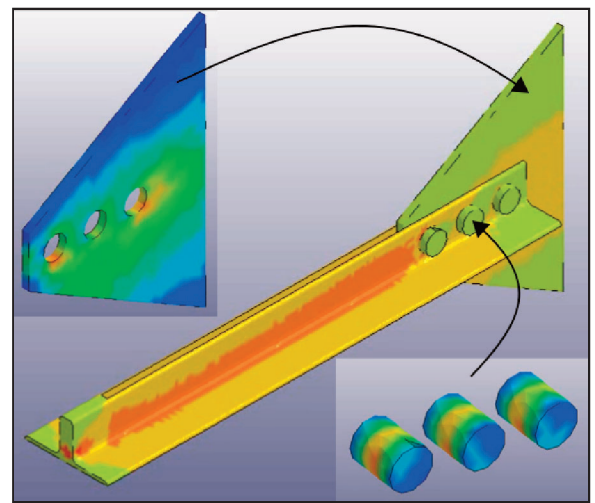


- *Fluid-Structure Interaction (FSI)*. Solid dynamics coupled with fluid in problems related to ground vehicles stability, occupant comfort performance of tall buildings, rotating machinery.
- *Computational Modeling of Multiphase Porous Media*. Theoretical, mathematical and numerical implementation of the mechanical behavior of porous media: constitutive modeling of porous concretes, consolidation of partially saturated soils, pollutant dispersion in ground water table, tumor growth simulation.



- *Mechanical Modeling of Materials.* Modeling of material behavior across multiple spatial scales. Development and application of constitutive theories describing mechanical, physical and coupled responses: Non-linear behavior, elasticity, elasto-plasticity, visco-plasticity. Developments based on homogenization methods. Specifically at LAMEC an alternative framework is been developed. The classical mixture theory and volume fraction concepts are replaced by the stress state decomposition technique and saturation degree.
- *Computational Material Design.* Design of compounds with tailored properties (metamaterials). Understanding of this new materials via theoretical and numerical approaches. Metamaterials and composite materials research applied to regional problems.
- *Computational Optimization.* Optimization formulations applied to problems such as microstructures topology optimization, optimal structural design (Figure 3) and inverse design. Different approaches: interior point algorithms (deterministic), genetic algorithms-like formulations (stochastic).
- *Discrete Elements Method (DEM) applied to fracture mechanics.* Computational mechanics applied to failure mechanisms. Numerical and computational models development. DEM applied to unstable spread of cracks. Determination of stress intensity factor, static and dynamic. Crack propagation studies.

**Figure 3:**  
Topological design  
of a structure



Particularly, regarding wind flow-related problems, LAMEC has a strong foundation in the experimental field. Several collaborative research lines/works are jointly developed with the Aerodynamics Laboratory of the Faculty of Engineering (Wind Tunnel facility). ●

**MECOM 2020**  
**XXXVII Argentine Congress for Computational Mechanics**  
**November 3-5, 2020**

Dear AMCA Members,

Beforehand, we want to express our sincere gratitude for your commitment in participating at the thirty-seventh edition of the Argentine Congress of Computational Mechanics. Unfortunately, given the current situation regarding SARS-CoV-2, we have been forced to cancel this year's edition of the mentioned Congress.

This was a difficult decision but we strongly feel that the health and safety of our potential attendees are of paramount importance. In addition, we have experienced innumerable drawbacks that would undermine the quality that MECOM Congresses used to have.

In a joint agreement with the Argentine Association for Computational Mechanics (AMCA), our city (Resistencia, Chaco) will again be the Congress venue for the year 2021, on a date to be yet confirmed.

We hope we can count once again on your support and with your distinguished presence. We will remain available to answer any questions that you may have in the future.

Best regards,

**Dr. Ing. Javier Mroginski** (Organizing Committee President)  
**Dr. Ing. Guillermo Castro** (Scientific Committee President)



# conference diary planner

13 - 16 Oct 2020	<b>MuSM2020 - 7th International Symposium on Multibody Systems and Mechatronics</b> Venue: Córdoba, Argentina Contact: <a href="https://amcaonline.org.ar/">https://amcaonline.org.ar/</a>
6 - 10 Nov 2020	<b>IGA2020 - Isogeometric Analysis 2020</b> Venue: Banff, Canada Contact: <a href="mailto:ruth@usacm.org">ruth@usacm.org</a>
16 - 19 Nov 2020	<b>XLI CILAMCE - XLI Ibero-Latin-American Congress on Computational Methods in Engineering</b> Venue: <b>ON-LINE</b> Contact: <a href="http://www.cilamce.com.br">www.cilamce.com.br</a>
10 Nov - 2 Dec 2020	<b>AfriComp - African Conference on Computational Mechanics</b> Venue: Cape Town, South Africa Contact: <a href="https://africomp2020.org/">https://africomp2020.org/</a>
8 - 11 Dec 2020	<b>COMSAFE 2020 - Computational Engineering &amp; Science for Safety &amp; Environmental Problems</b> Venue: <b>ON-LINE</b> Contact: <a href="https://www.compsafe2020.org/">https://www.compsafe2020.org/</a>
11 - 15 Jan 2021	<b>WCCM-ECCOMAS - 14th World Congress in Computational Mechanics &amp; ECCOMAS Congress</b> Venue: <b>ON-LINE</b> Contact: <a href="https://www.wccm-eccomas2020.org">https://www.wccm-eccomas2020.org</a>
1 - 5 March 2021	<b>CSE21 - SIAM Conference on Computational Science and Engineering</b> Venue: Fort Worth, Texas US Contact: <a href="http://Siam.org/Conferences/CM/conference/cse21">Siam.org/Conferences/CM/conference/cse21</a>
2 - 4 June 2021	<b>Marine 2021 - International Conference on Computational Methods in Marine Engineering</b> Venue: Edinburgh, Scotland Contact: <a href="https://congress.cimne.com/marine2021/">https://congress.cimne.com/marine2021/</a>
13 - 16 June 2021	<b>COUPLED 2021 – 1X International Conference on Coupled Problems in Science &amp; Engineering</b> Venue: Sardinia, Italy Contact: <a href="https://congress.cimne.com/Coupled2021/">https://congress.cimne.com/Coupled2021/</a>
21 - 23 June 2021	<b>COMPDYN 2021 - 8<sup>th</sup> International Conference on Computational Methods in Structural Dynamics &amp; Earthquake Engineering</b> <b>UNCECOMP 2021 – 4<sup>th</sup> International Conference on Uncertainty Quantification in Computational Sciences &amp; Engineering</b> Venue: Athens, Greece Contact: <a href="https://2021.compdyn.org/">https://2021.compdyn.org/</a>
21 - 23 June 2021	<b>ADMOS 2021 – X International Conference on Adaptive Modeling and Simulation</b> Venue: Gothenburg, Sweden Contact: <a href="https://congress.cimne.com/ADMOS2021/">https://congress.cimne.com/ADMOS2021/</a>
27 - 30 June 2021	<b>CSME 2021 - Canadian Society for Mechanical Engineering International Congress</b> Venue: Charlottetown, PEI Contact: <a href="https://www.csmecongress.org/">https://www.csmecongress.org/</a>
25 - 29 July 2021	<b>USNCCM16 - 16<sup>th</sup> U.S. National Congress on Computational Mechanics</b> Venue: Chicago, Illinois Contact: <a href="http://16.usnccm.org/">http://16.usnccm.org/</a>
22 - 27 Aug 2021	<b>25th ICTAM - International Conference of Theoretical and Applied Mechanics</b> Venue: Milan, Italy Contact: <a href="http://www.icta,2020.org/">http://www.icta,2020.org/</a>
7 - 10 Sept 2021	<b>COMPLAS 2021 XVI International Conference on Computational Plasticity</b> Venue: Barcelona, Spain Contact: <a href="https://congress.cimne.com/complas2021/">https://congress.cimne.com/complas2021/</a>
13 - 15 Sept 2021	<b>Structural Membranes 2021 – X International Conference on Textile Composites and Inflatable Structures</b> Venue: Munich, Germany Contact: <a href="https://congress.cimne.com/Membranes2021/">https://congress.cimne.com/Membranes2021/</a>
22 - 27 Aug 2021	<b>IUTAM Symposium on Computational fracture mechanics in multi-field problems</b> Venue: Milan, Italy Contact: <a href="https://iutam.org/">https://iutam.org/</a>
4 - 6 Oct 2021	<b>PARTICLES 2021 – VI International Conference on Particle-based Methods</b> Venue: Hamburg, Germany Contact: <a href="https://congress.cimne.com/Particles2021/">https://congress.cimne.com/Particles2021/</a>
17 - 21 Oct 2021	<b>21<sup>st</sup> International Symposium on Finite Element Methods in Flow Problems</b> Venue: Hangzhou, China Contact: <a href="https://iacm.info/scientific-events/fe/">https://iacm.info/scientific-events/fe/</a>
6 - 9 Nov 2022	<b>USACM Thematic Conference - Isogeometric Analysis 2020</b> Venue: Banff, Canada Contact: <a href="http://iga2020.usacm.org/">http://iga2020.usacm.org/</a>