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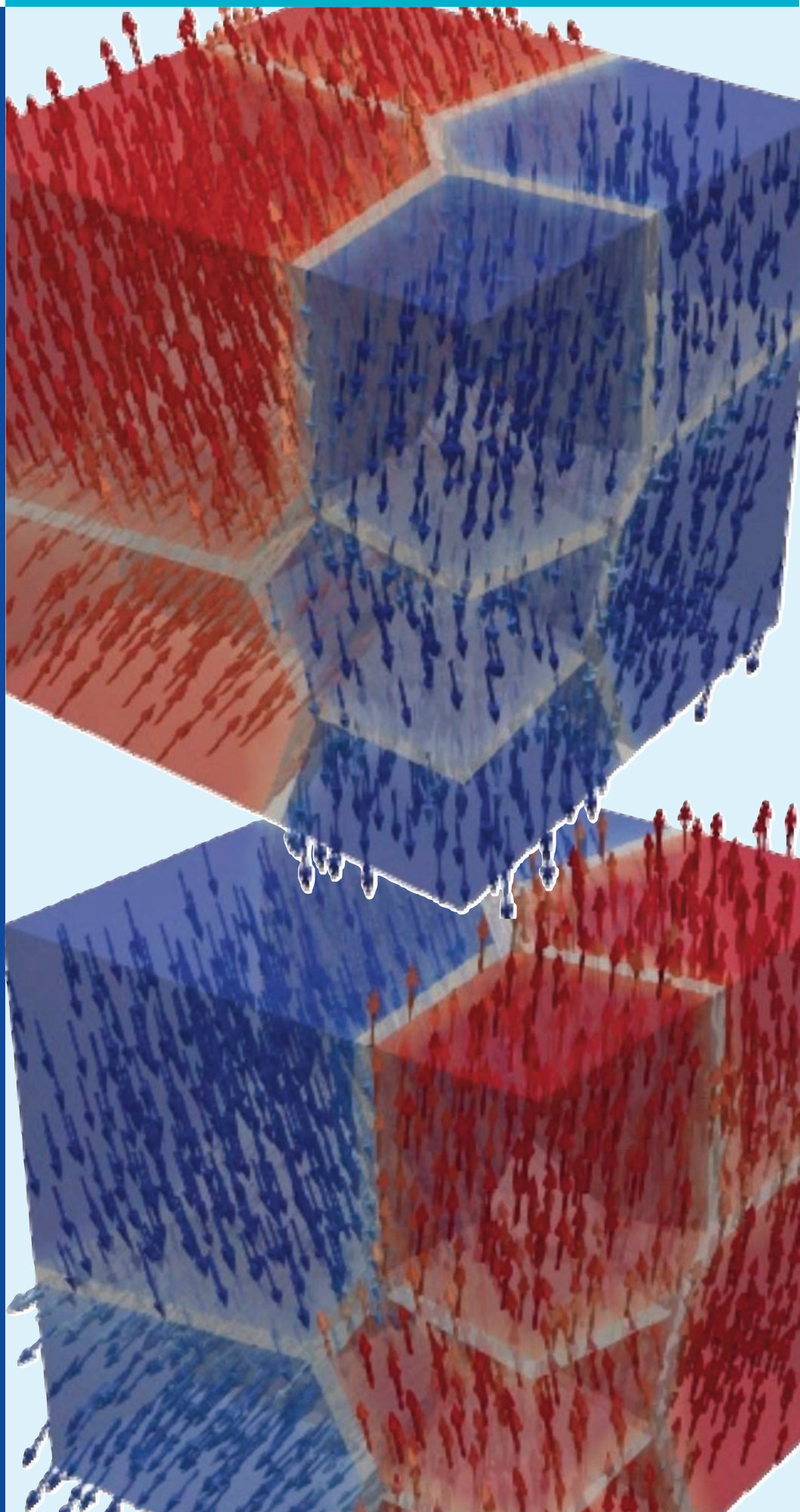

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contents

editorial

The International Association for Computational Mechanics (IACM) community experienced a profound and devastating loss last year with the passing of two towering figures in the field: Dr. J. Tinsley Oden, widely regarded as one of the founding fathers of computational mechanics, and Dr. I. Babuška, a seminal figure in the mathematics of the finite element method. Their expertise, guidance, and advice impacted the lives of countless people and shaped the trajectory of computational mechanics and applied mathematics. As we bid farewell to these giants, let us rely on their achievements as lights along a path towards a vibrant future.

Now, as part of this concerted effort to reinvigorate our community, the eagerly awaited face-to-face World Congress on Computational Mechanics (WCCM) is making a return after a six-year hiatus. The absence of in-person gatherings in Paris and Yokohama was undoubtedly a profound disappointment for the IACM community. The loss of those opportunities to convene and exchange ideas face-to-face was keenly felt by all. However, leveraging online conferencing tools, we were able to bridge the physical distance and engage in fruitful discussions and lively conversations. Even now that face-to-face meetings have resumed, these digital communication platforms continue to play an important role, and we believe that when used together they will continue to foster a more dynamic and interconnected community that is poised for further development in the field of computational mechanics.

The IACM was happy to announce a new award to recognize the achievements of "Mid-Career" computational mechanicians. The organization solicited the entire IACM community for suggestions of names for the new award and received an overwhelming response. After considerable deliberation by the members of the Executive Council, a name for the award has been determined. The new name will be announced at the WCCM in Vancouver this summer.

In closing, we are delighted to report on the sustained energy and enthusiasm within the international computational mechanics community, and look forward to seeing as many of you as possible at the upcoming World Congress.

With warm regards,
John Dolbow and Kenjiro Terada

High-Performance Magnets

- the power of simulations

by
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Some of the major challenges facing society today are the transition to renewable energies and the move towards e-mobility. The technical realization of this requires large quantities of efficient high-performance magnets, for wind turbines and electric motors of electric cars, for example. Magnets are therefore key materials for the energy transition.

What are the essential mechanisms in this energy conversion technology?

If a relative movement takes place between a magnetic field and an electrical conductor within it, an electric current flows in the conductor (when the circuit is closed). The resulting voltage and current depend on the speed of the relative movement and the strength of the magnetic field. The speed can be controlled using gears (this involves mechanical losses!), and the strength of the magnetic field can be increased using new high-tech magnets. The most efficient magnets in the field of energy production are currently neodymium-iron-boron ($Nd_2\,Fe_{14}\,B$) magnets [2]. The diagram in *Figure 1* illustrates the global demand for $Nd_2\,Fe_{14}\,B$-magnets and provides a forecast up to 2030.

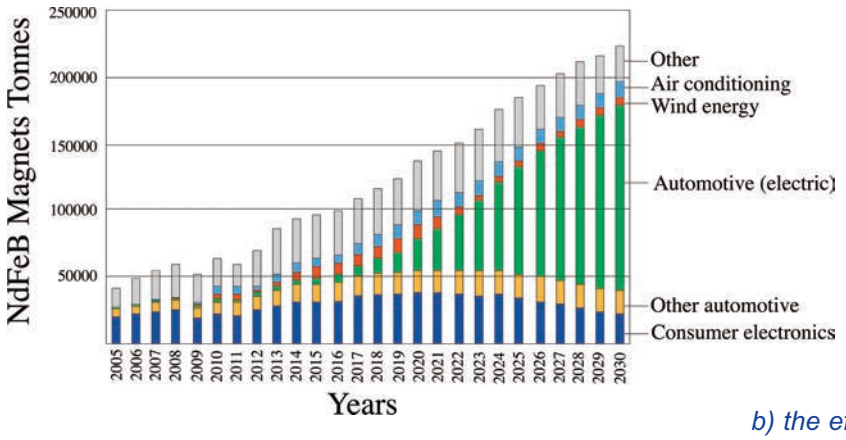


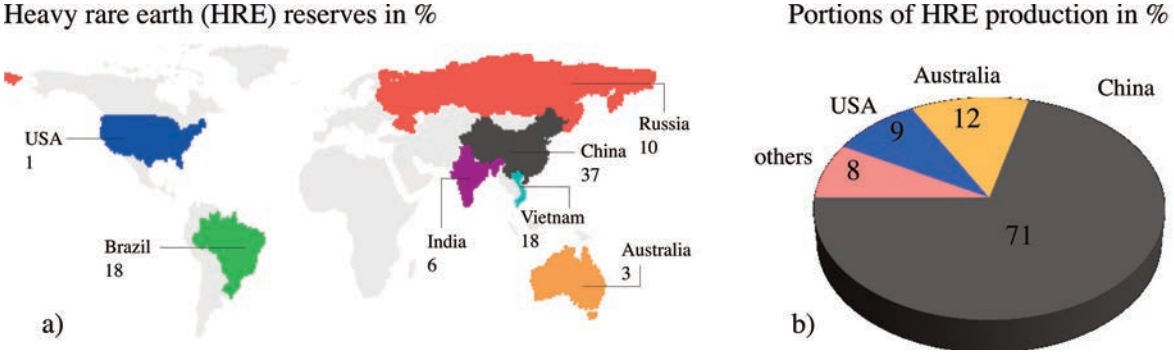
Figure 1:
Global demand for $Nd_2\,Fe_{14}\,B$ magnets [1]

The electromobility sector is particularly striking, with demand expected to increase significantly in the coming years. However, these magnets often consist to a significant extent of heavy rare earth materials that are not geopolitically available in sufficient quantities for all countries, see *Figure 2*. The increasing demand for these so-called hard magnets in e-mobility and energy conversion raises the question of increasing the efficiency of classic high-tech magnets (based on rare earth materials) or the integration of substitute materials [3,4]. It is not only the criticality of the materials themselves that plays an important role, but also the conditions under which they are mined and their availability on the global market. Many rare earths are mined with severe environmental impacts and often stem from politically autocratic countries, as shown in *Figure 2a) & b)* [5,6]. Ideally, substitute materials should be degradable in a minimally invasive way for humans and the environment and come from countries with guaranteed continuous accessibility to avoid dependencies that could be used as political leverage.

The scientific/technical challenge:

The microstructural composition is decisive in optimizing the magnetic properties. The so-called Brown's paradox [7], expresses the potential for improving magnetic performance. This paradox describes the difference between hard magnets' theoretical and experimental performance. The most important parameters for assessing a magnet's performance are the coercive field strength H_c and the so-called remanence M_r.

Figure 2:
a) the reserves &
b) the effective production of rare earths by country [5]



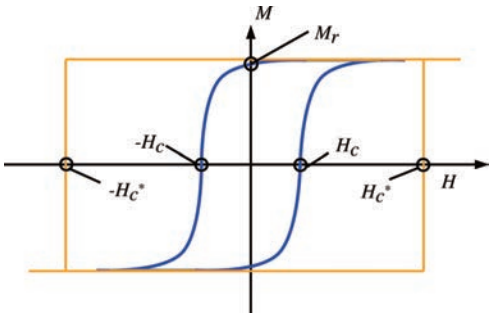


Figure 3:
Illustration of theoretical (yellow) and experimentally (blue) observed hysteresis curves

An illustration of the hysteresis of a hard magnet is depicted in *Figure 3*. The yellow curve represents the theoretically attainable values determined by the crystal anisotropy, while the blue curve represents experimentally observed quantities. The difference in the coercivities offers considerable potential for performance optimization. The reasons for this gap can be manifold: Non-magnetic inclusions or impurities, misoriented domains, and non-decoupling grain boundaries see, e.g., Kronmüller [8]. Ideally, the grain structure of a sintered hard magnet consists of many small ferromagnetic grains with uniaxial anisotropy separated by a non-ferromagnetic intermediate layer. Reducing grain size within the microstructure can improve the magnetic properties [9]. However, if this non-ferromagnetic intermediate layer is missing, the nucleation of a grain can lead to a cascade-like magnetization reversal, as [9] demonstrates. As already mentioned, an optimal microstructure can lead to improved powerful magnets. Simulations can assist in finding those optimized microstructures.

Simulation of magnetic material behavior:
Numerical simulations are essential to make precise recommendations and predictions for optimal microstructures. The framework of micromagnetism has proven suitable for predicting magnetic behavior on a sub-micrometer scale. Magnetization vectors $\boldsymbol{M}=M_s\boldsymbol{m}$ are introduced as continuum field variables for describing the magnetic domains and their evolution [10]; M_s denotes the saturation magnetization, and $\boldsymbol{m}$ is a unit vector [11, 12]. Gilbert's equation can approximate the time evolution of the magnetization, *Equation (2)*, where competing energy contributions are introduced in the total magnetic enthalpy function $\mathscr{H}$ [13, 14].

$$\operatorname{div} \boldsymbol{B} = 0 \qquad \text{with} \qquad \boldsymbol{B} = \boldsymbol{\mu} \cdot (\boldsymbol{M} + \boldsymbol{H}) \tag{1}$$

$$\dot{\boldsymbol{m}} = -\mu_0\gamma_0 \boldsymbol{m} \times \boldsymbol{H}^{\text{eff}} + \alpha\, \boldsymbol{m} \times \dot{\boldsymbol{m}} \qquad \text{with} \qquad \boldsymbol{H}^{\text{eff}} = \frac{-1}{\mu_0 M_s} \left(\partial_{\boldsymbol{m}}\mathscr{H} - \operatorname{div} \partial_{\nabla \boldsymbol{m}}\mathscr{H}\right) \tag{2}$$

The effective magnetic field $\boldsymbol{H}^{\text{eff}}$ represents the influences on the switching behavior of the magnetization vectors. Together with the magnetic Gauss law Eq. (1), the Gilbert equation forms the basis of the simulations and enables the numerical analysis of magnetic materials, such as the polycrystalline structure shown in *Figure 4*. This micromagnetic framework is a phase-field theory. However, within a Finite-Element scheme the element sizes must be below the exchange length l_{exc}. Hence, the resulting equation systems can easily exceed several millions of degrees of freedom [16].

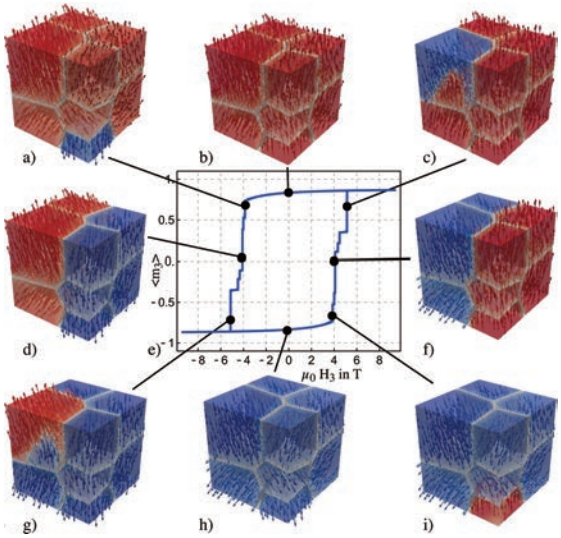


Figure 4:
a)-d) & f)-i) polycrystalline hard magnetic microstructure under alternating external magnetic field H_3 and magnetization vectors $\boldsymbol{m}$, and e) effective hysteresis loop [15]

An effective hysteresis loop of a polycrystalline microstructure is depicted in *Figure 4*. The microstructure measures 600 nm in each direction. It comprises ten $\mathrm{Nd_2\,Fe_{14}\,B}$ grains separated by a 12 nm thick Nd-rich grain boundary. The initial orientation of the magnetization vectors is aligned with the easy-axis of the grains (*Figure 4b)*), which deviates from the vertical axis by ±15°. Without external magnetic influences, the magnetization distribution would remain unchanged. Applying an external alternating magnetic field in the vertical direction results in switching the magnetizations within the grains, see *Figure 4*. The paramagnetic layer between the ferromagnetic grains causes a magnetic decoupling of the individual grains. This is why we observe an independent switching of the individual grains. If we plot the external magnetic field against the volume average of the magnetization, we

"... allows conclusions to be made about potential improvements to the microstructural composition without having to carry out expensive and time-consuming experiments...."

obtain the magnetic hysteresis curve, *Figure 4e)*. Here, the switching of the grains manifests itself in the form of small "steps"; the more steps are visible, the more grains switch independently of each other, see [9]. A magnetic decoupling generally leads to improved coercive field strength and, thus, to stronger magnets. During the manufacturing process of hard magnets, so-called secondary phases can form, which can negatively influence the magnet's effective behavior. We evaluate seven grains magnetically decoupled by a 5 nm thick Nd-rich grain boundary as a simplified microstructure. Furthermore, we consider soft magnetic *α*-Fe inclusions within the hard magnetic $Nd_2Fe_{14}B$ grains as a secondary phase to analyze this phenomenon [17]. No decoupling grain boundaries exist between the secondary and hard magnetic phases. The initial magnetization is parallel to the easy axis of anisotropy, shown in *Figure 5a)* in the form of red arrows. A switching of the magnetization is induced by an alternating external magnetic field in vertical direction. α-Fe has a lower coercivity than $Nd_2Fe_{14}B$; thus, the nucleation of the magnetization reversal starts at these secondary phases [18]. Since there are no separating grain boundaries between these two phases, the magnetization reversal of the hard magnetic $Nd_2Fe_{14}B$ also begins here, followed by a complete reversal of the microstructure [9]. Therefore, the early magnetization reversal of the hard magnetic material can be attributed to premature nucleation by the soft magnetic secondary phase. This can be seen in the magnetization patterns, as well as in the effective hysteresis (blue curve in *Figure 5b)*). An analysis of the microstructure without secondary phases results in the red hysteresis in *Figure 5b*). The comparison of the two hysteresis curves clearly shows the negative influence of the secondary phases in the microstructure, with the coercive field strengths differing by around 2 Tesla.

Figure 5:
Magnetic characterization of microstructure with secondary phases. a) geometry, b) effective hysteresis curves, c)-e) magnetization patterns [17]

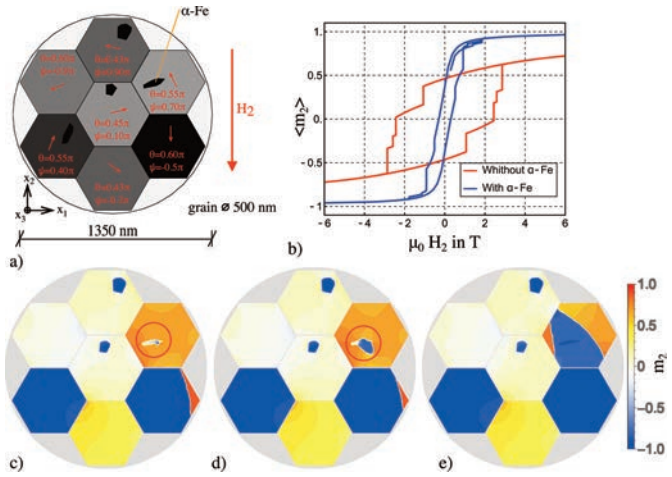
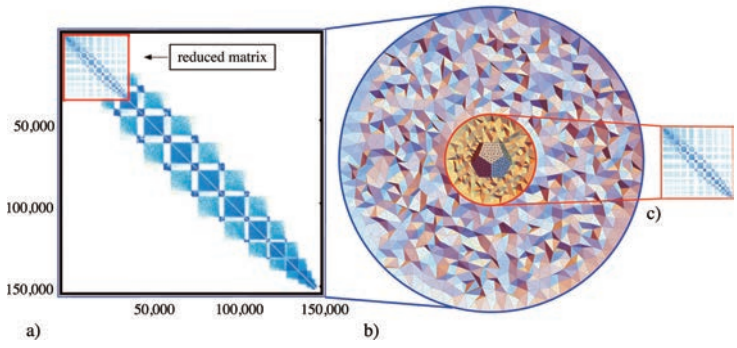


Figure 6:
Magnetic particle embedded within a ball-shaped free space: b) boundary value problem, dimension of system matrix for a) full resolved system and c) reduced system [23]



Demagnetization fields:

Magnets generate magnetic fields inside and outside the magnetic solid. These magnetic fields are the demagnetization or stray fields and significantly impact the magnetic response. Depending on the application, the free space surrounding the magnet must be considered to predict the evolving stray fields. The stray field intensity decays with increasing distance to the magnetic solid. Various approaches for the computation of stray fields can be found in the literature, e.g., the BEM [21] or the SBFEM [22]. A brute force but very straightforward approach is discretizing a large but finite fraction of the free space with finite elements, as presented in *Figure 6b)*. A rule of thumb estimates the free space to be at least five times larger than the magnetic solid [20]. The considered problem requires the prescription of boundary conditions at infinity [19]. This straightforward approach can lead to significantly larger system matrices and unnecessary long computing times. Another efficient and straightforward approach is the condensation of the surrounding external space onto the surface of the volume (magnet) of interest by a static condensation (Schur complement) [23]. With this approach, huge and densely meshed outer space areas can be treated very efficiently, as the outer space only needs to be considered within a preliminary condensation. The condensation of the outer space onto the surface of the inner space to be analyzed leads to system matrices that resemble the system matrix shown in *Figure 6c*) in appearance and density. The comparison of the two matrices in *Figure 6a*) shows a significant reduction in the dimensions of the condensed matrix compared to the entire matrix. The resulting condensed matrix is significantly denser compared to the initial FEM system matrix.

Nevertheless, a significant speed-up can be observed depending on the system, especially if many time steps are required.

Conclusion:

Magnetic materials play an important role in our daily lives and are essential for technological progress. A deep understanding of the underlying magnetic phenomena on a mathematical and physical level is required to drive this progress further. The behavior of magnetic materials can be calculated using Maxwell's and Gilbert's equations, which enable in-silico characterization. This allows conclusions to be made about potential improvements to the microstructural composition without having to carry out expensive and time-consuming experiments each time, which can often only provide limited insights. Combining experiments and numerical calculations opens up the possibility of making the development process for magnetic materials more efficient and precise.

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Seismic Metamaterials:

A Novel Approach for Alleviating Earthquake Damages

by
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Phononic crystals (PCs) and acoustic metamaterials have raised intensive and extensive interests of many researchers in the past few decades. PCs are artificially well-designed periodical systems consisting of elastic scatters embedded in a host matrix with a high impedance difference between the matrix and scatters. In the early days, PCs first originated from electronic crystals and photonic crystals for electromagnetic wave manipulation. In a very early monograph, Brillouin [1] indicated periodical elastic wave, electromagnetic wave, and electrodes in the crystal can be treated as analogical systems as they have some common properties like Brillouin zone, Bragg scattering, etc. The properties are produced by diffraction and reflection of light, acoustic, or elastic waves in different crystals and periodical structures. Therefore, they are independent of wave format. Kushwaha et al. [2] compared the properties of electronic crystals, photonic crystals, and phononic crystals. Although there are differences in many aspects including lattice constant, material properties, model differential equation, spectral region, etc., the research on electronic crystals and photonic crystals can supplement useful information for development of PCs because they share similar mathematical and modeling expressions.

Generally, there are two main mechanisms to generate bandgap, Bragg scattering and local resonance. Most of the previous studies focus on Bragg scattering because the design for Bragg scattering mechanism is generally simpler and easier. When lattice constant of PCs is comparable to wavelength, the reflected wave will possibly intervene negatively in the neighboring unit cells which produces a bandgap. However, it is hard to fabricate PCs with low-frequency bandgap as it requires enormous sizes of unit cells. The application of PCs is thus highly restricted. Liu et al. [3] first reported low-frequency bandgap based on local resonance mechanism. The corresponding wavelength of the new bandgap is two orders of magnitude larger than lattice constant, which breaks the size restriction of Bragg scattering bandgap. Since then, artificial structures that embed local resonance units by sub-wavelength in the periodical matrix have been widely studied for vibration control, noise control, acoustic black hole, waveguiding, acoustic cloak, etc.
Elastic wave metamaterials can be classified as a class of specific acoustic metamaterials. Compared with light waves, elastic waves have lower frequencies and longer wavelengths. Therefore, with the advantages of high efficiency, lightweight, wide bandgap, and low-frequency, elastic wave metamaterials have attracted much interest of researchers. Inspired by the capabilities of artificial structures above, a class of super-low frequency metamaterials, apparently another specific stream of elastic wave metamaterials, has been comprehensively studied in the aspects of seismic wave shading, seismic isolation, and many other ultra-low frequency ranges. Seismic waves originate from the energy-releasing procedure of the earth surface or near blow. The waves show the characteristics of long wavelength, long-distance propagation, and other peculiar wave response. Compared with normal stress waves, seismic waves are more powerful and destructive. Therefore, many factors like nonlinear constitutive of materials, plastic response of structures need to be considered when designing a structure against seismic waves.

The traditional seismic isolation methods depend on the strength of building, structural design, as well as plasticity and elasticity of materials such as increasing the structure stiffness, introducing joint and foundation flexibility, etc. These methods have two main drawbacks. On one hand, the protection of target building is passive, on the other hand, the entire building structures have to be modified thus causing possibility of disturbing the structural integrity and large displacement of foundation. Subsequently, researchers began to explore whether seismic wave propagation can be designable, tunable, and controllable. While it may not work if traditional structure isolation design methods are considered, it is very possible if acoustic materials and seismic metamaterials are used. With its superiority in manipulating seismic waves, therefore, these ultra-low frequency metamaterials become a potential design candidate for a novel engineering approach for alleviating earthquake damages.

Development of Seismic Metamaterials

Basic research situation

The basic design idea of seismic metamaterials is changing the local character of ground surface by arranging different structural components in a sub-wavelength scale. Generally, seismic waves are damaging to structures and buildings via the following mechanisms (*Figure 1*): soil-foundation-structure [4]. Unlike any traditional isotropic medium, foundation soil has many complex phenomena like nonlinear behavior, which makes the design and experiment on seismic metamaterials very complicated.

From the database of Web of Science, research papers relevant to seismic metamaterials only contribute to approximately 8-9% of works on elastic wave metamaterials. One of the main reasons is the enormous size of seismic metamaterials that significantly increases the difficulty of any experiments. The other is related to geological conditions of ground surface which complicate the elastic wave field. Therefore, most of the current research is limited to only theoretical analysis and numerical simulation. Experiments, especially full-scale experiments, have been extremely rare. There are mainly two approaches in theoretical analysis: (i) the dispersion relation analysis with periodical conditions using methods like transfer matrix method (TMM), plane wave expansion (PWE) method, finite element method (FEM), etc., and (ii) designs of negative stiffness dynamic vibration absorber or negative bulk modulus chiral structure based on local resonance mechanism. Numerical simulation usually requires the use of commercial finite element software such as COMSOL Multiphysics, ANSYS or others to derive the dispersion relation and wave propagation modes.

Theoretically, it is practicable to control the propagation of seismic wave via designing anisotropic medium artificially. The idea of seismic metamaterials started to attract the attention of common people after the full-scale experiment conducted by Brûlé in 2014 [5]. Periodically distributed holes were drilled in the experiment and the area was treated as an enormous metamaterial. They proved, in theory, numerical analysis and experiment that the surface seismic wave around 50 Hz can be effectively filtered by the periodical structures. Indeed, the idea of using metamaterials in civil engineering to manipulate seismic waves or wave propagation due to ambient vibration was proposed a few years earlier. Shi and his research team proposed the periodic foundation [6] and periodic wave barriers [7] in 2010 and 2013, respectively, and verified their effectiveness experimentally [8]. Using materials common in civil engineering, they designed unit cells that consists of steel circular cylinders (0.245m radius) and rubber coating (0.245m thick) embedded in concrete as shown in *Figure 2(a)*, and obtained the complete frequency bandgap ranging from 14.51 Hz to 20.67 Hz as shown in *Figure 2(b)* [6].

Unfortunately, there are two main drawbacks: (i) any actual seismic wave frequency is always lower than 20 Hz; and (ii) the experiments did not consider the discrepancy of soli properties at different areas. Nevertheless, the works still verified the feasibility of applying seismic metamaterials for anti-seismic structures and provided precious data on filtering low-frequency waves. In 2017, Brûlé designed another large-size experiment to study the destructive

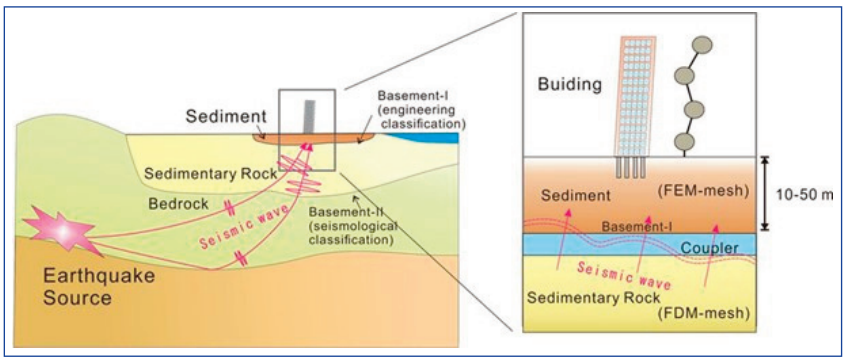


Figure 1:
Propagation mechanism of seismic wave [4]

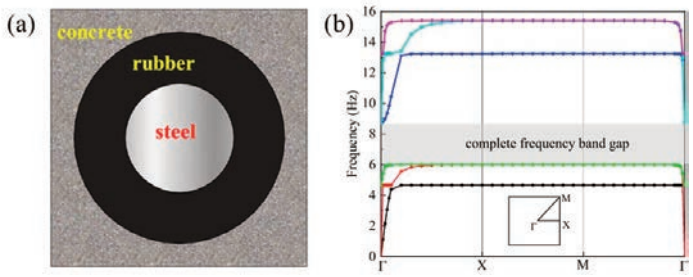
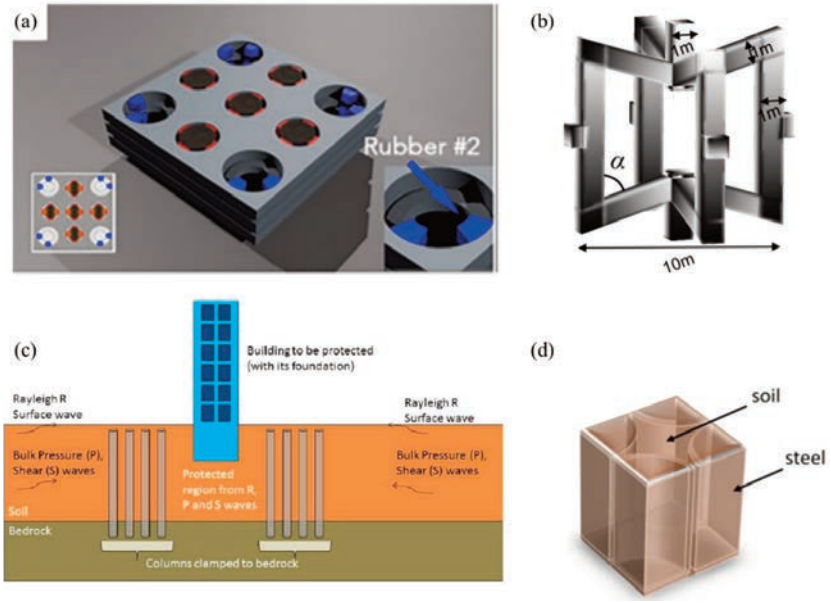


Figure 2:
(a) Unit cell configuration. (b) In-plane elastic modes of a square lattice of steel cylinder coated with rubber polymer in a concrete matrix. The inset shows the first irreducible Brillouin zone [6]

environmental signal propagating along ground surface [9]. They constructed a latticed structure by periodically drilling cylindrical holes on structural soil and control the frequency of excitation wave below 10 Hz. The result showed the characters of seismic metamaterials like effective dynamic, anisotropic properties can be fully exploited to control seismic surface waves, which is similar to the induction of negative reflective index in elastic wave metamaterials. In addition, some seismic metamaterial models were proposed at this period, for example, composite layered structures with attenuation zone *(Figure 3a)*, negative Poisson's ratio seismic metamaterials (*Figure 3b*), seismic metamaterial clamped to bedrock (*Figure 3c)*, and low frequency and large-scale phononic crystals (*Figure 3d*).

Figure 3:
(a) Composite layered structures with attenuation zone [10]; (b) negative Poisson's ratio seismic metamaterials [11]; (c) seismic metamaterials clamped to bedrock [12]; and (d) low frequency and large-scale phononic crystals [13]



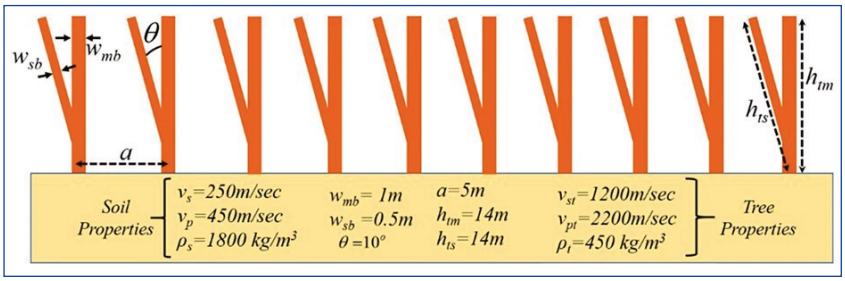
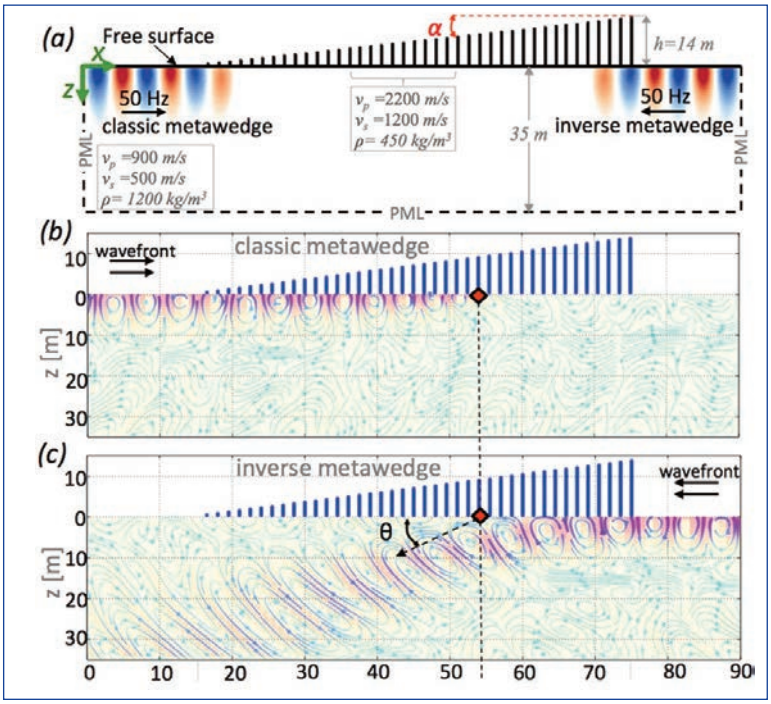


Figure 4:
Trees as resonators with soil and tree properties [17]

Seismic metamaterials in nature

The laws of nature always instil new and innovative ideas to researchers. Neil et al. [14] reported that moth wing is a natural metamaterial. This phenomenon is generated by the low-frequency resonance of trees, which is similar to the local resonance in acoustic metamaterials. Although the excitation frequency was lower than 150 Hz, they indicated the resonance frequency was inversely proportional to the resonator length. Therefore, it is possible to design a structure whose resonance frequency is lower than 10 Hz and apply to seismic Rayleigh wave attenuation. The idea raises much interest of the researchers in considering forest as a possible class of seismic metamaterials. Subsequently, Lata et al. [15] introduced a new remote sensing approach by exploiting the geometric phase which is generated by scattering of trees in forest environments. Muhammad et al. [16] reported that Rayleigh wave experiences strong attenuation when the vertical component of Rayleigh wave is coupled with longitudinal resonant modes of trees. Consequently, trees can be treated as a natural way of providing local resonance metamaterials and the approach is able to present wide low-frequency bandgap upon structural optimization. However, the said work only simplified trees as vertical column-type resonant units without considering other tree properties like branches, leaves, roots, etc. As shown in *Figure. 4*, Muhammad and Lim [17] published a further work on the influence of bulky branches connected with main tree stem. By analyzing the dispersion relation, they reported that the structure had a wide bandgap at around 20 Hz.

Figure 5:
(a) The geometry & material parameters; (b) increasing resonator height relative to the direction of incident Rayleigh wave; & (c) decreasing resonator height relative to the direction of incident Rayleigh wave [18]



Artificial seismic metamaterials

Artificial metamaterials protect target structures by forming a shield whose bandgap range is close to seismic wave dominant frequency ranges. Considering only the vertical dimension, an outer shield seismic metamaterial can be further divided into surface structure, which is similar to forest metamaterials, and underground artificial structures. In 2016, Colombi et al. [18] designed a metasurface at the geophysical scale which is made of spatially graded vertical subwavelength resonators on an elastic substrate (*Figure 5*). They first studied the effects of increasing resonator height relative to the direction of incident Rayleigh wave and observed “rainbow trapping”. Comparatively, when resonator height decreases relative to the direction of incident Rayleigh wave, the Rayleigh wave can be transferred into shear wave.

However, the upper ground structures usually occupy a lot space and areas surrounding the buildings, which is not acceptable in urban construction. For example, Ni et al. [19] designed a novel shallow buried periodic in-filled pipe barrier *(Figure 6*). It reported complex dispersion analysis for evaluating the decay of surface waves and the influence of material damping. By finite element numerical simulations and laboratory scaled experiments, the proposed periodic in-filled barrier shows excellent performance in low-frequency surface wave attenuation. The novel wave barriers are suitable not only for both passive and active isolations, but the attenuation zones could be further enhanced via a gradient layout of the in-filled pipes if there is limited barrier width.

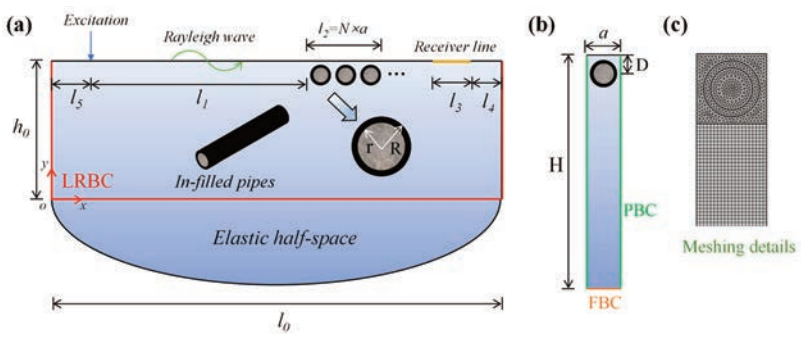


Figure 6:
2D plane strain models of shallow buried (or underground) periodic in-filled pipe barriers. (a) Transmission model; and (b) typical unit cell for dispersion analysis; (c) meshing details of the unit cell [19]

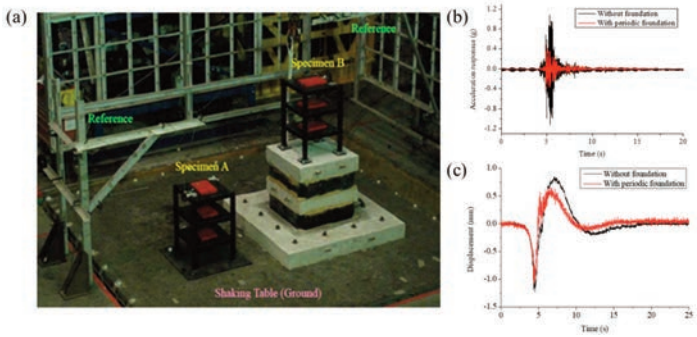


Figure 7:
Horizontal and vertical dynamic responses at the top of the frames under the 1975 Oroville earthquake. (a) Test setup, (b) Horizontal acceleration response under the 1975 Oroville earthquake, and (c) Vertical displacement time history under the 1975 Oroville earthquake [8]

Experiment Methods

Lab-scale experiments

Because of huge volumes and sizes, complex construction area, and extremely high costs, scaled-model experiments instead of full-scale experiments, are more favorable in the study of seismic metamaterials. In 2012, Xiang et al [8] presented an experimental study on the performance of a layered periodic foundation as shown in *Figure 7*. It was found that the reduction of peak horizontal acceleration can be as much as 50% and the vertical response can be reduced by 15.9% when the excitation frequency falls into the bandgaps.

Ni et al. [19] (*Figure 8*) conducted laboratory scaled experiments to verify the surface wave attenuation efficiency using shallow buried periodic in-filled pipe barrier. A concrete container with 3.3m×2.3m×2m in dimension and a soft sponge were used to wrap around the inside walls of the concrete container to reduce undesired wave reflection. The experimental setup shown in *Figure 8* included function generator, signal acquisition, amplifier and computer. The periodic in-filled pipe barriers were not fully buried underground to clearly demonstrate the shallow burying characteristics.

Full-scale experiments

Brûlé et al. [5] designed the first full-scale experiment for seismic metamaterials. As shown in *Figure 9*, 3-row by 10-column holes were drilled with diameter and depth of 0.32m and 5m, respectively, and with 1.73m separation intervals. The frequency of vibrating source in the experiment was 50Hz, while the lateral amplitude was 0.014m. The experiment results verified the capability of Bragg scattering of metamaterials for effectively attenuating the elastic seismic wave around 50Hz. Huang et al. [20] conducted another experimental study on the wave isolation performance of periodic barriers. They employed a very advanced state-of-the-art high-force triaxial (T-Rex) shaker truck to generate excitation. Although researchers observe the importance and needs of full-scale experiments, the difficulty and complexity encountered still discourage many researchers. Related works are still rare and further experimental works are very much required.

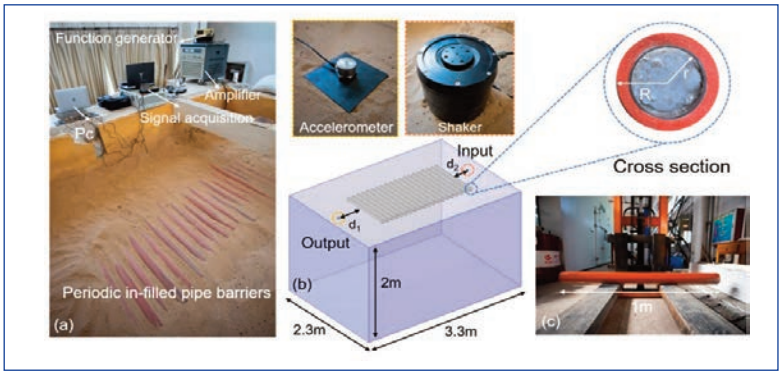


Figure 8:
Experiment setup and specimens of in-filled pipes for vibration mitigation. (a) Experimental setups for testing surface wave attenuation (periodic in-filled pipe barriers are not fully buried); (b) schematic of sandbox and experimental layouts; and (c) details of in-filled pipes [19]

Conclusion and Prospect

Structural vibration control has been developed for decades of years. The vibration isolation techniques like active control, passive control, hybrid control have received extensive attention and there are already many research outcomes that can be applied to actual practical works. By contrast, most research on seismic metamaterials focuses on theory and numerical analysis. Full-scale experiments are relatively very rare, which causes the very slow development of real and engineering applications of seismic metamaterials. The factors listed below may provide ideas for future study.

Geological Conditions. Many researchers treat the geological condition as a single layer soil. The complexity of soil conditions such as multilayer, underground water level, bedrock position, soil bearing capacity should be considered.

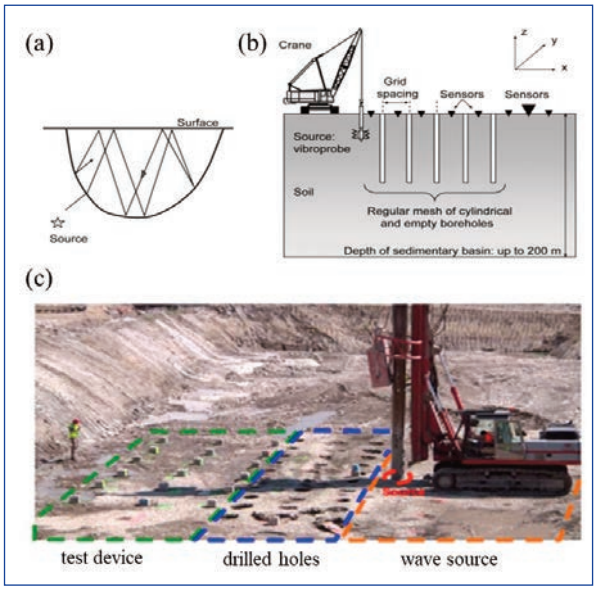


Figure 9:
(a) A full-scale experiment of seismic metamaterials: (a) wave source; (b) sketch of experiment; and (c) picture of the experiment [5]

Soil-structure Dynamic Interaction. The dynamic interaction between soil and structure has been studied in geotechnical engineering for decades of years. However, this approach has been rarely considered in designing seismic metamaterials and related structures.

Loading Capacity. Most of the existing metamaterials only consider seismic wave isolation but ignore their loading capacity and stability of the entire structure.

Material, Geometric and Inertia Nonlinearities. The current theoretical and simulation works of seismic metamaterial are based on linear assumptions while nonlinearities with respect to material, geometric and inertia properties are not taken into consideration at all. Although experiment is the most important approach for the exploration of seismic metamaterials, the development of more precise theoretical and numerical models taken in account the various aspects of nonlinearities is, by all means, indispensable.

Besides, the application of other PCs properties such as negative refraction, on seismic metamaterials is still unexplored. The application of deep learning, machine learning for optimizing seismic metamaterials is still absent in general. Overall, the novelty, reliability, and applicability of seismic metamaterials provide new innovative ideas and great potentials for engineering seismic isolation applications. In conclusion, any research in seismic metamaterials should be fully promoted, encouraged, and financed. ●

"Full-scale experiments are relatively ... rare, which causes ... very slow development ...."

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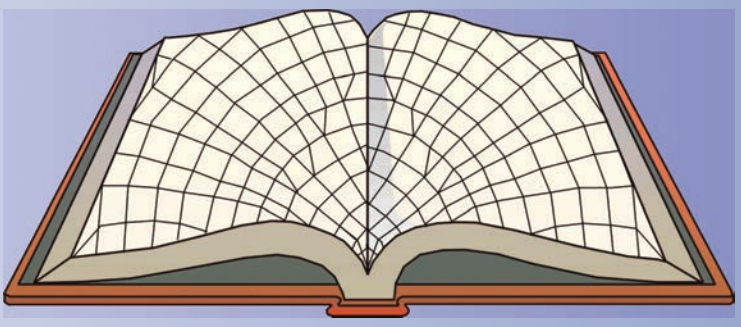
Structural Dynamics

Peretz P. Friedmann, George A. Lesieutre and Daning Huang
Cambridge University Press, UK, 2023



BOOK REVIEW

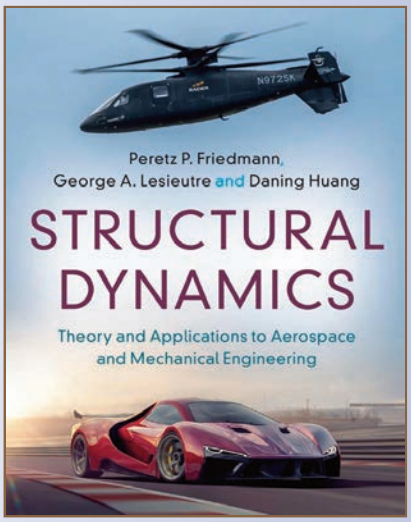
ISBN: *1108842488, 564 pages, hard cover, $79 (List Price)*

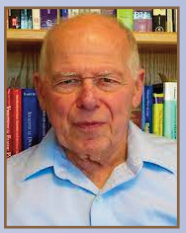
Contents: *Preface; 1: Review: Dynamics of Single Degree of Freedom Systems; 2: Principles of Structural Dynamics; 3: Natural Modes of Vibration: Continuous Systems; 4: Finite Element Method and Model Reduction; 5: Natural Modes of Vibration: Discrete Systems; 6: Damping; 7. Dynamic Response of Structures; 8. Structural Dynamics of Rotating Systems; 9. Stability and Response Problems of Periodic Systems; Appendix A: Linear Algebra and Matrix Methods; Appendix B: Laplace Transforms; Appendix C: Gaussian Quadrature; Appendix D: Pseudocode for Describing Algorithms; Index.*

This book is part of the Cambridge Aerospace Series, edited by Wei Shyy and Vigor Yang. The first author is a chaired professor at the Department of Aerospace Engineering at the University of Michigan. The other two authors are faculty members at the Department of Aerospace Engineering at Penn State University.

This is an excellent and comprehensive general text on structural dynamics, with an added flavor in aerospace engineering and in computational mechanics. It includes, in addition to standard material, some advanced topics that are not often found in other books on structural dynamics. Most notable in this regard are *Chapter 8* on rotating systems and *Chapter 9* on stability and response of periodic systems. It is most appropriate that these subjects are included, as the first author is a well-known authority in the field, who has made pioneering contributions to it. However, these are not the only subjects that are unique to this book. I would also place *Chapter* 6 on damping in this category, as well as the part of *Chapter 5* that discusses various advanced methods for the solution of vibration eigenvalue (EV) problems, and the part of *Chapter 7* on time integration methods. The latter two subjects can certainly be found in some texts dedicated to computational methods, but I am not aware of any other book on structural dynamics that discusses them in such a thorough and modern way. A variational approach is taken in many cases to derive governing equations, boundary conditions and solutions.

The book is very well structured and edited, and easy to read, with many fine illustrations and many worked examples. At the end of each chapter there is a bibliography list and well-thought problems. Algorithms are nicely written in pseudo-code. Available online material includes a solution manual, the figures and tables appearing in the book, and MATLAB and Python codes.

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Chapter 1 is a standard treatment of single degree-of-freedom (SDOF) systems.

Chapter 2 reviews various basic principles in structural dynamics. This chapter includes a discussion on generalized coordinates, a brief introduction to the calculus of variations, virtual work, Hamilton's principle (including for non-conservative systems, e.g., with follower forces), and Lagrange's equations, among other subjects.

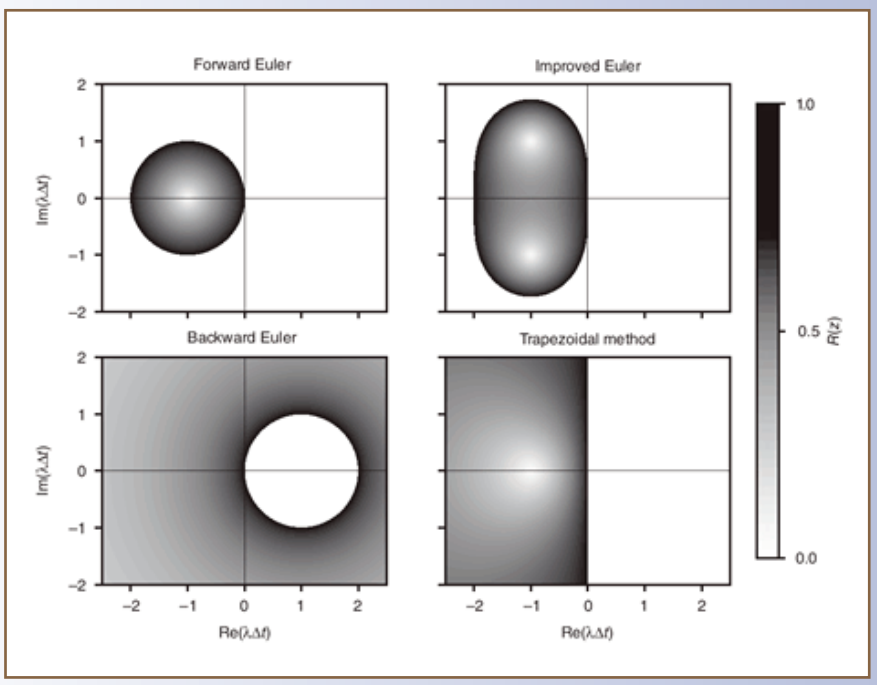
Chapter 3 already discusses continuous systems. Many books and courses introduce multi-DOF discrete systems before continuous systems, as studying the treatment of a system of ODEs is regarded as easier for the student than the treatment of a PDE. However, it is a sensible pedagogical approach to discuss first continuous systems (after the unavoidable SDOF systems) and only later discrete systems (here in *Chapter 5*), since the latter are generated by the approximation of continuous systems, e.g., by the Finite Element (FE) method. For the advanced audience that this book is intended for, I believe that the approach taken here is more suitable.

Chapter 3 discusses modal analysis of beams and plates. In addition to vibration of the classical Bernoulli-Euler beams and Kirchhoff plates, the chapter covers vibration modes of Timoshenko beams and the von Kármán plate theory, involving geometrical nonlinearity. Both analytical solutions and numerical methods are discussed, the latter being based on the Rayleigh-Ritz method and the Galerkin method.

Chapter 4 discusses the FE method for rod, beam (both Bernoulli-Euler and Timoshenko) and rectangular plate structures. Section 4.9 is dedicated to model reduction, and discusses various methods like CMS, truncated normal modes, Guyan reduction and the Craig-Bampton method.

Chapter 5 introduces modal analysis of discrete systems. The generalized EV problem is discussed in detail, and methods of its solution are nicely surveyed. These include power iteration, inverse iteration, Jacobi's method, QR (the theoretical and practical versions), subspace iteration and the Lanczos algorithm. Nonsymmetric EV problems are also briefly discussed.

Chapter 6 is devoted to the subject of damping, and includes discussions on damping representation via a complex stiffness, and on Rayleigh damping. As written on p. 318, "no physical justification is provided" for Rayleigh damping, and for extreme frequencies (on both sides of the spectrum) this damping model provides poor predictions. Indeed, one has to admit that Rayleigh damping is more of a practical and numerical convenience than anything else. *Chapter 6* also includes sections on viscoelastic materials (with a nice discussion on hereditary integrals), and on Coulomb friction.



Chapter 7 covers the time-dependent response of structures, and approximate time-integration methods. Implicit and explicit methods are discussed as well as adaptive time-stepping. The Newmark family of algorithms is introduced and the properties of its members are discussed; see *Figure 1*.

Figure 1:
Stability region of different Euler time-integration methods
This is Figure 7.7 in the book

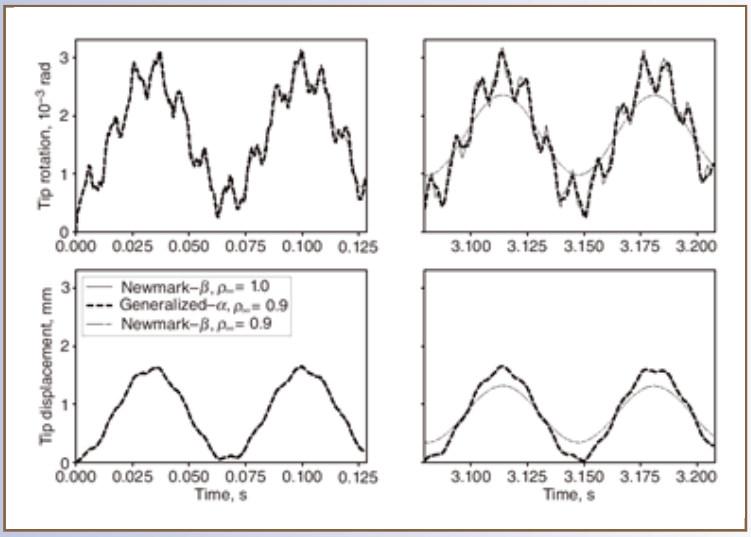


Figure 2:
Comparison of Newmark and Generalized-α (HHT) methods
This is Figure 7.21 in the book

The Generalized-α (HHT) method is presented as an improvement for the Newmark method; see *Figure 2*. The chapter ends with a short section on implicit time-integration for nonlinear problems.

Chapter 8 is about rotating systems, with obvious application to the dynamics of shafts, turbine blades, propeller blades and helicopter rotor blades. This chapter focuses on the presentation of the governing equations and the solution of EV problems for linear rotating systems. Section 8.3 discusses the equations of motion of a rotating Bernoulli-Euler beam, with a variational approach. The effect of the Coriolis acceleration is nicely presented. Section 8.8 introduces a blade with a cross section oriented at some angle with respect to the plane of rotation (e.g., due to aerodynamic design). In such a configuration there is coupling between the in-plane and out-of-plane rotations.

Chapter 9 discusses stability and response of periodic systems. Section 9.2 presents a simple illustrative model of a beam under time-periodic axial load. The authors show how this configuration leads to the Mathieu equation, if the load is sinusoidal, and to Hill's equation in the more general periodic case. Incidentally, in the mathematical literature, the name Mathieu equation usually relates to the specific loading term cos(2t), while here the more general term cos(θt) is considered. The regions of stability and instability of the Mathieu equation are graphically shown in the so-called Ince-Strutt diagram. See *Figure 3*. Section 9.5 discusses the Floquet theorem, which provides the form of the transformation matrix for periodic systems. Its main importance is in that it leads to an EV problem whose solution determines the stability of the system.

No book is flawless, and this book is no exception. There are some typos or unexplained notation in some places, and at least one concept that could be explained more clearly. Hopefully these will be corrected in the second edition of the book. Also, I found it slightly strange that what seems to be a set of two equations written one after the other (sometimes with two different equation numbers) are in fact the same equation written differently. It would have been better to insert some text (e.g., "namely") between the two equations. However, all these "flaws" are very minor, and do not pose any difficulty in reading and understanding the book.

In summary, this is a highly recommended text on structural dynamics, which is unique in several respects as indicated above. It will serve as a valuable source for advanced students and structural engineers who are not afraid from serious computing, as well as for members of the computational mechanics community. ●

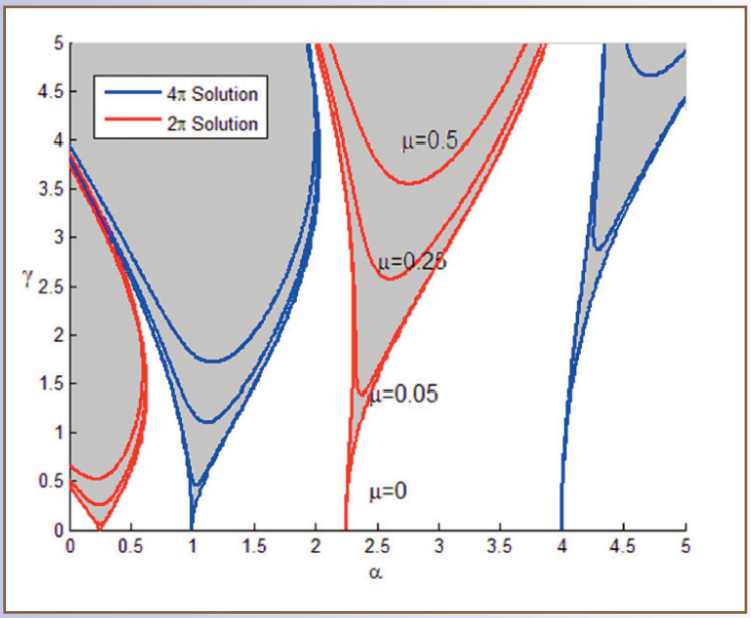


Figure 3:
The Ince-Strutt diagram showing regions of stability and instability for the Mathieu equation. A black-white version of this diagram appears as Figure 9.2 in the book. The color version shown here is taken from the paper by H. Moideen, J.M. Falzarano and S.A. Sharma, Ocean Systems Eng., Vol. 2, pp. 239-255, 2012, published by Techno-Press Journals

MECOM 2023
XXXIX Argentine Congress on Computational Mechanics
I Argentine – Uruguayan Congress on Computational Mechanics

Concordia, Entre Ríos, Argentina – Salto, Salto, Uruguay
6 to 9 November 2023

The XXXIX Argentine Congress on Computational Mechanics and theI Argentine – Uruguayan Congress on Computational Mechanics (MECOM 2023) took place from November 6th through November 9th, 2023, in the cities of Concordia, Entre Ríos, Argentina and Salto, Salto, Uruguay. This new edition of the annual AMCA meeting and the first binational Congress was organized by the Concordia Regional Faculty of National Technological University (FRCon -- UTN), Argentina, and the Water Department at the Northern Regional University Center (CENUR) of the University of the Republic, Uruguay, together with the Argentine Association for Computational Mechanics (AMCA).

Figure 1:
Opening Ceremony, from left to right:
Prof. Pablo Gamazo (Uruguayan chair of the congress),
Prof. Víctor Fachinotti (President of AMCA),
and Ing. José Jorge Penco (Argentinian chair of the congress)

The Organizing Committee included Eng. José Jorge Penco (Chairman Argentina), and Prof. Pablo Gamazo (Chairman Uruguay). The Scientific Committee was chaired by Prof. Mario Storti with Prof. Pablo Ezzatti and Prof. Eugenia Garat as Co-Chairmen.

The Congress hosted six Invited Lecturers, Prof. Sergio Idelsohn (International Center for Numerical Methods in Engineering, CIMNE, Barcelona, Spain), Prof. Rainald Löhner (George Mason University, USA), Prof. Cristian Gebhardt (Geophysical Institute (GFI) and Bergen Offshore Wind Centre (BOW), University of Bergen, Norway), Prof. Marcela Cruchaga (Departamento de Ingeniería Mecánica Universidad de Santiago de Chile (USACH), Santiago, Chile), Prof. Marco Dentz (Spanish National Research Council (IDAEA-CSIC), Barcelona, Spain), and Prof. Adrian Lew (Department of Mechanical Engineering, Stanford University, Stanford CA, USA).

Figure 2:
All conference participants at the UTN-FRCon main entrance

Full-length papers were submitted to a peer review process prior to publication. Accepted papers have been published in the proceedings series “Mecánica Computacional”, which are openly available at the following website: ***http://www.amcaonline.org.ar/mcamca***.

The Conference consisted of 20 Technical Sessions with more than 220 papers presented.

A special session was devoted to under-graduate students, with awards for best posters, that were granted to:

1. *Delfina Criado*, from the Applied Multiphysics Research Group (GIMAP) of the National Technological University at Bahia Blanca, Argentina.
2. *Martín Zanatta*, from National Technological University (UTN) at Santa Fe, Argentina.
3. *José Fernández Palmieri* from the Applied Multiphysics Research Group (GIMAP) of the National Technological University at Bahia Blanca, Argentina.

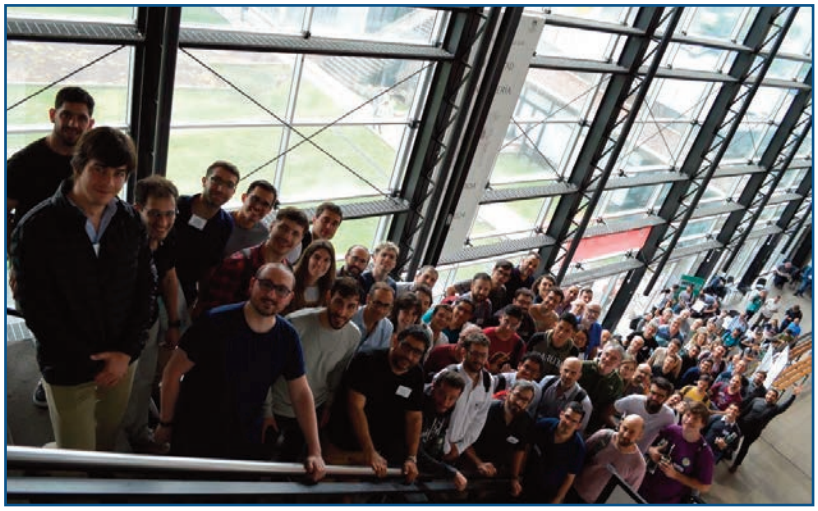


Figure 4:
All conference participants at the CENUR-Litoral Norte, Salto, (Udelar) main stairs

Figure 3:
Prof. Mario Storti, president of the scientific committee of MECOM 2023

Figure 5:
Prof. Sergio Idelsohn, in the name of all AMCA members recognize Prof. Víctor Fachinotti for his services to the Association during the last years

New Authorities

During the Congress, took place the regular 2023 assembly of AMCA members. In addition, as every second year, AMCA members elected a new directive board that will be active during the 2024-2025 period. The new directive board is constituted as follows: President: Pablo A. Kler, Secretary: Laura Battaglia, Treasurer: Gerardo Franck, Comission members: Santiago Urquiza, Sebastián Giusti, Sebastián Machado, Javier Signorelli, Martín Idiart, Juan Manuel Podestá, Sonia Vrech, Juan Ramos Nervi, Oscar Moller y Miguel Cousirat. All AMCA members warmly thanked Prof. Victor Fachinotti for all these years of service.

Call for Papers

The Argentine Association for Computational Mechanics (AMCA) announces the **XL Argentine Congress on Computational Mechanics (MECOM 2024)**, to be held in Rosario, Argentina, organized by Facultad de Ciencias Exactas, Ingeniería y Agrimensura (FCEIA), of the Universidad Nacional de Rosario (UNR).

The following speakers have already confirmed their participation at the MECOM 2024:
Carlos Tomé (Los Alamos, USA), Reinald Löhner (George Mason University, USA), Rodney Fox (University of Iowa, USA), Pablo Mininni (Universidad de Buenos Aires, Argentina), Daniel Fuster (Universidad Sorbonne, Francia), Stéphane Zaleski (d'Alembert, Francia), Alberto Passalacqua (University Iowa, USA) and Ivo Roghair (TU Eindhoven, Netherlands).

https://amcaonline.org.ar/mecom2024/.

APCOM 2019

The 7th Asian Pacific Congress on Computational Mechanics (APCOM 2019), organized by The Association of Computational Mechanics Taiwan (ACMT), was held from December 17 to 20, 2019, at the Taipei International Convention Center (TICC) in Taipei City. ACMT organized the conference grandly. This conference specially invited 24 internationally renowned scholars to deliver plenary and semi-plenary speeches, including former President of the Austrian Academy of Sciences, Prof. Herbert Mang, National Academy of Sciences member, Prof. David J. Srolovitz, former Presidents of IACM, Prof. Wink-Kang Liu and Prof. Antonio Huerta and former President of the US Association for Computational Mechanics, Prof. J-S Chen, among others. Additionally, 182 scholars from both domestic and international institutions were invited to chair 147 minisymposia, with a total of 638 papers presented.

Legal Establishment of ACMT

The Association of Computational Mechanics Taiwan (ACMT) was founded in 2007 to strengthen the development and collaboration between researchers in the field of computational mechanics in Taiwan. Many members of ACMT are also regular mini-symposium organizers and speakers for WCCM and APCOM events. To continue deepening and promoting the academic research and application of computational mechanics in Taiwan and internationally, we formally applied to the Ministry of the Interior to register the society in 2022. The founding conference invited members to share their latest research findings and featured panel and group discussions to lay down the roadmap for the future development of ACMT.

Figure 1:
ACMT founding conference group photo

Figure 2:
Computational Mechanics Trend Forum

Figures 3 & 4:
The founders discussed the future of ACMT

Annual ACMT Conference 2023

The annual meeting and conference of the Association of Computational Mechanics Taiwan (ACMT) 2023 & The 14th Workshop on Boundary Element Methods in Taiwan was successfully held in Taiwan on October 28-29, 2023. The conference was organized by the National Taiwan Ocean University and co-organized by the National Science and Technology Council.

Figure 5:
Annual meeting & conference of the Association of Computational Mechanics Taiwan (ACMT) 2023

At the opening ceremony, the conference chairman and current ACMT president, Prof. C-S David Chen, on behalf of the organizing committee, welcomed all the guests who come to the conference onsite, including the president of National Taiwan Ocean University, Prof. Tai-Wen Hsu.

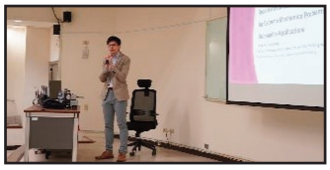
There were 2 plenary presentations at the conference. In the first plenary presentation session, Prof. Hong-Ki Hong from National Taiwan University presented “Computing Saint-Venant Flexure-Torsion and Warping in Three Dimensions.” (*Figure 8*) Prof. Jiun-Shyan Chen from

Figure 6:
Prof. C-S David Chen, the president of ACMT

Figures 7:
Prof. Shu-Wei Chang, t he secretary general of ACMT

Figure 8:
Prof. Hong-Ki Hong, National Taiwan University

Figure 9:
Prof. Jiun-Shyan Chen, University of Californian, San Diego, USA



Figures 10:
Prof. Tsung-Hui Huan

Figures 11:
Prof. Yu-Hsi Huang

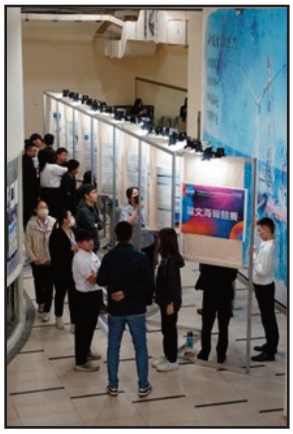
Figures 12:
Prof. Ting-Ying Chou

Figures 13:
Prof. Cheng-Hsien Lee

University of Californian, San Diego, USA, in the second plenary presentation session, presented “Thermodynamics-based Data-driven Computing for Inelastic Materials Modeling.”

There were also 4 semi-plenary presentations onsite. Prof. Tsung-Hui Huang from National Tsing Hua University presented “Recent Advances in Meshfree Formulation for Extreme Mechanics Problems in Submarine Applications” *(Figure 10)*. Prof. Yu-Hsi Huang from Chung Yuan Christian University presented “The Application Research of Computational Mechanics in Acoustic Components and micro-power generation components” (*Figure 11*). Prof. Ting-Ying Chou from National Cheng Kung University presented “Revealing the Enigmas of Brain Tissue Displacement and Cerebral Pressure Distribution through Poroelastodynamics” (*Figure 12*). Prof. Cheng-Hsien Lee from National Sun Yat-sen University presented “Development of Multi-phase Model for Sediment Transport” (*Figure 13*).

ACMT 2023 13 minisymposia, with a total of 117 submissions received. There were 27 entries in the student poster competition and 126 abstracts. We sincerely appreciate everyone's participation in the ACMT 2023.



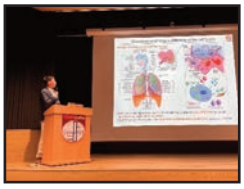
Figures 14:
The student poster competition

Special Lecture Event

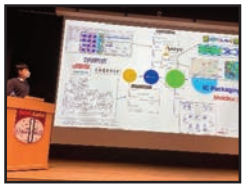
In early 2023, ACMT held a special lecture event with 60 participants. Prof. J.S. Chen was invited to deliver a keynote speech titled "When Machine Learning Meets Computational Mechanics - A New Paradigm in Scientific Computing." (Figure 15) Additionally, several Taiwanese scholars were invited to give brief presentations: Research Fellow Chun-Wei Pao presented "Machine Learning and Atomistic Simulations for Nanomaterial Mechanics." (*Figure 16*) Prof. Chien-Kai Wang delivered a presentation on "Continuum Mechanics of Extreme Response Analysis and Measurement Noise Reduction for Stokes Flow Under Uncertainty." (*Figure 17*) RD Manager Li-Hsuan Shen spoke on "Application of Numerical Simulation to Advanced IC Packaging." (*Figure 18*) Prof. Tsung-Hui Huang presented "Stabilized Galerkin Meshfree and Machine Learning Formulation for Advection Dominated Flows." (*Figure 19*)

Figures 15:
Prof. J.S. Chen,
Uni. of Californian

Figures 16:
Research Fellow
Chun-Wei Pao



Figures 17:
Prof. Chien-Kai Wang



Figures 18:
Manager
Li-Hsuan Shen

Figures 19:
Prof. Tsung-Hui Huang

Short Courses

To deepen the roots of computational mechanics, ACMT organized short courses on June 17, 2023, and January 15, 2024, respectively. The total number of registrations for these courses accumulated to nearly 90 participants. Thanks to Prof. Chi-Hua Yu from National Cheng Kung University and Prof. Li-Wei Liu from National Taiwan University for hosting these two events.

Figures 20 & 21:
Short Course hosted by Prof. Chi-Hua Yu (June 17, 2023)

Figures 22 & 23:
Short Course hosted by Prof. Li-Wei Liu (January 15, 2024)

More

For more information and the latest news about ACMT, you are welcome to visit our website **https://www.acmt.info/**.

UKACM 2024 Conference

The next UKACM conference will be hosted by the Department of Engineering of Durham University, from 10th-12th April202, chaired by Professor Will Coombs..

The following plenary speakers have agreed to speak at the conference:

- Professor Xiaoying Zhuang, Leibniz University Hannover
- Professor David Emerson, Science and Technology Facilities Council (STFC)
- Professor Jon Trevelyan, Durham University
- Dr Tim Hageman, UKACM 2022 Roger Owen PhD thesis prize winner and best ECCOMAS PhD thesis of 2022, Imperial College London/University of Oxford.

The conference will be complemented by a half day School on the afternoon of Wednesday 10th April 2024 focused on computational methods for solid mechanics, speakers and topics as follows:

- Professor Jon Treveyan, Introduction to the boundary element method
- Professor Charles Augarde, Introduction to the material point method
- Dr Stefano Giani, Introduction to discontinuous Galerkin finite element methods.

Further details can be found in -
https://sites.google.com/view/ukacm2024conference

First UKACM Autumn School

From 6th-8th September 2023 the first UKACM Autumn School was organised by the Glasgow Computational Engineering Centre. The school focused on theoretical aspects and hands-on activities related to mixed finite element formulations in solid mechanics.

Speakers and lectures delivered were:
- Dr Ignatios Athanasiadis, Taylor-Hood element with block solvers
- Dr Andrei Shvarts, Mixed formulation for thermo-elasticity
- Professor Lukasz Kaczmarczyk, Multifield formulation for plasticity. Mixed formulation for large strain incompressible hyperelasticity
- Dr Chun Hean Lee, Explicit fast-transient solid dynamics. Stabilised FEM for 1D linear elasto-dynamics
- Dr Callum J. Runcie, Hands-on training sessions with topics related to the first-order hyperbolic system for large strain solid dynamics.

The recordings can be found in **https://www.youtube.com/playlist?list=PLbqyPFhdeLn-fq4OLtlMkrcwh9S-yXJpt**

Open Call to organise the 2024 UKACM-SEMNI Autumn School

Interested parties are invited to submit an expression of interest (maximum 2 pages) to both the UKACM and SEMNI presidents, outlining their background and expertise in Computational Mechanics, their vision and objectives for the proposed Autumn School, the proposed theme and potential speakers and the hands-on activities.

The Autumn School is expected to be an online event with no registration fee, to be held during the last two weeks of September 2024 and have a duration of 2 to 4 days. ●

Members of the UKACM executive committee

Following an election process, two new academics have been selected UKACM executive committee members taking the roles of secretary and ECCOMAS YIC Representative.

The current executive committee is formed by:

- Jose Luis Curiel-Sosa, Prizes Coordinator, University of Sheffield
- Omar Laghrouche, Treasurer, Heriot-Watt University
- Irene Moulitsas, Webmaster, Cranfield University
- Rubén Sevilla, President, Swansea University
- Wei Tan, ECCOMAS YIC Representative, Queen Mary University of London
- Zahur Ullah, Secretary, Queen's University Belfast

The current co-opted members are René de Borst, Jelena Ninic, Chris Pearce, Mohammad Rezania and Will Coombs, due to their involvement in IACM, ECCOMAS and in organising UKACM conferences. ●

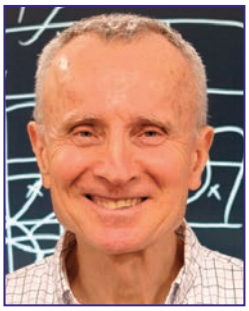
2022 Roger Owen PhD Thesis Award

The call for the Roger Owen UKACM prize for the best PhD thesis in 2023 is now open. Eligible are applicants whose thesis was awarded in 2023.
The prize consists of:

- A monetary award of £1,000, sponsored by the European Journal of Computational Mechanics.
- An invitation to the UKACM's annual conference as a plenary speaker and, provided the awardee attends the conference and delivers the talk, the sum of £500 to cover expenses.
- An automatic nomination to the ECCOMAS PhD Awards. ●

USACM Awards Honorees

The following awards were presented to USACM honorees during the **17th U.S. National Congress on Computational Mechanics** in Albuquerque, New Mexico, July 23-27, 2023.

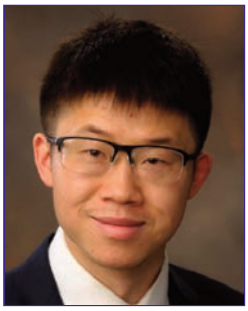


John von Neumann Medal
Tayfun Tezduyar
Rice Uni. & Waseda Uni.

Belytschko Medal
David Benson
Ansys, Inc.

Thomas J.R. Hughes Medal
Kenneth Jansen
Uni. of Colorado at Boulder

J. Tinsley Oden Medal
Karen Willcox
Oden Institute
The Uni. of Texas at Austin



Gallagher Young Investigator Medal
Jinhui Yan
Uni. of Illinois at Urbana-Champaign

USACM Fellows

Alireza Doostan
Uni. of Colorado at Boulder

Hector Gomez
Purdue University

Habib Najm
Sandia National Lab.

Siddiq M. Qidwai
National Science Foundation

Rekha Rao
Sandia National Lab.

Karen Willcox
Oden Institute
Uni. of Texas at Austin

Figure 2:
Prof. Thomas J.R. Hughes from the Oden Institute of The University of Texas Austin

Advances in Computational Mechanics
(ACM 2023)

Advances in Computational Mechanics, a Conference Celebrating the 80th Birthday of Thomas J.R. Hughes with Special Track in Computational Fluid-Structure Interaction: Frontiers in Methods and Applications (CFSI 2023) was held October 22-25, 2023 in Austin, Texas, USA.

Over 250 participants gathered to celebrate the 80th birthday and long successful career of Prof. Thomas J.R. Hughes from the Oden Institute of The University of Texas Austin. The conference featured technical talks in 26 areas related to computational fluid-structure interaction and advancements in the field computational mechanics over nine parallel sessions.

It also featured plenary talks from Yuri Bazilevs, Hector Gomez, Ming-Chen Hsu, Wing Kam Liu, Herbert Mang, Alison Marsden, Eugeñio Onate, Marie Oshima, Kenji Takizawa, Robert Taylor, Tayfun Tezduyar, Karen Willcox, and Peter Wriggers.

Photos from the conference may be found at https://flic.kr/s/aHBqjB2udz ●

USACM Upcoming Events

- **1Quarter Century of Peridynamics,** *April 23-25, 2024*, Tucson, Arizona
- **Second Thematic Conference on Uncertainty Quantification for Machine Learning Integrated Physics,**
  August 12-14, 2024, Crystal City, Arlington, Virginia
- **IGA 2024,** *October 27-30*, 2024, St. Augustine, Florida

Further information may be found at **usacm.org**. ●

Report from
the Japan Association for Computational Mechanics

The Japan Association for Computational Mechanics (JACM) is a union of researchers and engineers working in the field of computational mechanics mainly in Japan. The 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 330. JACM members actively participate in the IACM activities.

Figure 1:
Professor Hiroshi Okada, President of JACM, reporting about the recent activities of JACM

On September 9th, 2023, the 2023 JACM annual meeting and award ceremony were held in Green Computing Systems Research and Development Center of Waseda University in Tokyo. The meeting was also broadcasted by Zoom to remote participants (*Figure 1*).

In this year, JACM inducted three new honorary members. Before the award ceremony, new honorary members were introduced. They have distinguished records of researches and services to computational mechanics related professional societies. The new honorary members are Professor Takayuki Kitamura (Professor Emeritus, Kyoto University), Professor Eiji Nakamachi (Professor Emeritus, Doshisha University) and Professor Ryutaro Himeno (Juntendo University). Each of new honorary members gave a short speech, after their introductions.

Following the introduction of the new honorary members, the award ceremony took place. There are three categories in the JACM Awards: the JACM Computational Mechanics Award which is the highest award, the JACM Fellows Award and the JACM Young Investigator Award. Professor Toru Ikeda (Kagoshima University), Professor Mikio Sakai (The University of Tokyo) and Makoto Tsubokura (Kobe University) were awarded 2023 the JACM Computational Mechanics Award (*Figure 2*). The recipients of the JACM Fellows Award were Professor Satoshi Ii (Tokyo Metropolitan University), Dr. Hiroshi Watanabe (Hexagon) and Professor Yasushi Nakabayshi (Toyo University) (*Figure 3*). The winners of JACM Young Investigator Award were Professor Kentaro Yaji (Osaka University), Professor Yasunori Yusa (The University of Electro-Communications) and Professor Takuya Terahara (Waseda University) (*Figure 4*). ●

(a) *(b)* *(c)*

Figure 2:
Recipients of the 2023 JACM Computational Mechanics Award,
(a) Professor Toru Ikeda (Kagoshima University)
(b) Professor Mikio Sakai (The University of Tokyo) and
(c) Professor Makoto Tsubokura (Kobe University)



(a) *(b)* *(c)*

Figure 3:
Recipients of the 2023 JACM Fellows Award,
(a) Professor Satoshi Ii (Tokyo Metropolitan University),
(b) Dr. Hiroshi Watanabe (Hexagon) and
(c) Professor Yasushi Nakabayshi (Toyo University)



(a) *(b)* *(c)*

Figure 4:
Recipients of JACM Young Investigators Award,
(a) Professor Kentaro Yaji (Osaka University),
(b) Professor Yasunori Yusa (The University of Electro-Communications) and
(c) Professor Takuya Terahara (Waseda University)

The second part of the annual meeting was the fourth JACM awardee seminar. The purpose of this seminar series is to have researchers who received the JACM awards recently give lectures on their latest research activities. Two lectures were given in the seminar. The first one entitled “Current Topics on Computational Mechanics in Biomedical Engineering” was presented by Professor Tomohiro Otani (Osaka University), who is the JACM Young Investigator Award winner of year 2022. The second one was “Digitalization of Computational Fluid Mechanics: How Are Complexities of Fluid Flow Grown and Observed?” given by Professor Nobuyuki Oshima (Hokkaido University), received the JACM Computational Mechanics Award of year 2022. At the end of the 2023 JACM meeting, we took a group photo (Figure 3). ●

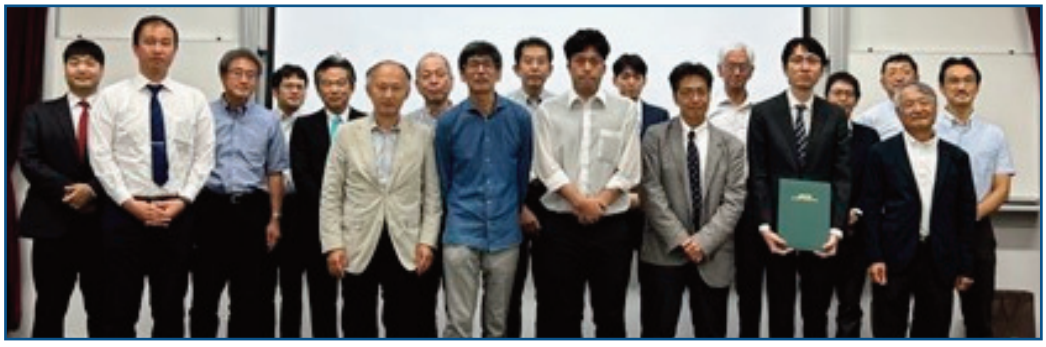


Figure 5:
Group Photo (All the participants)

6th German-Japanese Workshop on Computational Mechanics

The 6th German-Japanese Workshop on Computational Mechanics was held on December 4-5, 2023, in Aachen, Germany. This workshop was supported by the German Association for Computational Mechanics (GACM) and the Japan Society for Computational Engineering and Science (JSCES) and aimed to promote cooperation and exchange between the two countries in the field of computational mechanics. The workshop covered various topics such as fracture mechanics, material modeling, topology optimization, finite element methods, isogeometric analysis, and high-performance computing.

The workshop was attended by 26 participants from Germany and Japan, who presented their latest research results and discussed the current challenges and future directions of computational mechanics. The workshop also featured two keynote lectures by Prof. Wolfgang Wall from TU Munich (*Figure 1*) and Prof. Toshio Nagashima from Sophia University, who shared their insights and experiences on the applications of computational mechanics to biomedical engineering and composite materials, respectively. On the second day, an optional tour to the Jülich Supercomputing Centre (JSC) was organized, where the participants had the opportunity to visit the HPC system JUWELS and the quantum computer JUPSI, and learn about the Center of Excellence RAISE, which focuses on artificial intelligence and machine learning for engineering applications (*Figure 2*).

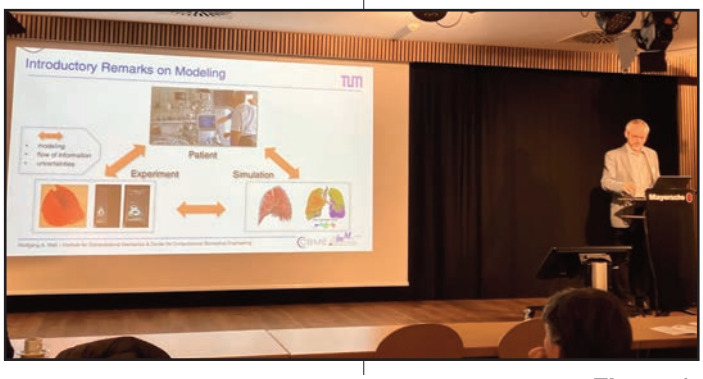


Figure 1:
Keynote lecture by Prof. Wolfgang Wall from TU Munich

Figure 2:
In front of the quantum annealing machine of the Jülich Supercomputing Centre

The workshop was a great success, as it provided a platform for stimulating discussions, knowledge exchange, and networking among the participants. We express our deep gratitude to GACM, the speakers, and the participants for their contributions and support. ●

Summer Camp for Students

The summer camp for students is a successful series hosted by JSCES from 2013. The event was held online from 2019 to 2022 due to COVID-19, but in 2023 we were able to hold it onsite in Tsukuba, Ibaraki, Japan (*Figure 3*). The summer camp for students 2023 featured a poster session (*Figure 4*) led by young researchers and students in a traditional Japanese-style room, and the Best Poster Award was presented to two students.

Figure 3:
Participants of the JSCES summer camp for students 2023

Figure 4:
Discussions at the poster session

Four doctoral students presented their ongoing research and their motivation for entering the doctor course, and 4 keynote speakers gave talks on their research experiences and their career in universities, national laboratories, and industry. ●

COMPSAFE2025

The The Japan Society of Computational Engineering and Science (JSCES) and the Japan Association for Computational Mechanics (JACM) will jointly host the 4th International Conference on Computational Engineering and Science for Safety and Environmental Problems (COMPSAFE2025) which will be held during July 1st-4th, 2025, in Kobe, Japan.

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

Other main topics of the conference include, but are not limited to: computational mechanics, computational engineering and science technologies, and their applications related to (1) safety- / risk-related, disaster-preventing topics including various types of natural hazards such as earthquake, tsunami, typhoon / hurricane / cyclone, flood, explosion of volcano, landslide, (2) any kinds of accidents and failures of engineering artifacts such as fractures, crashes, explosion, and (3) environmental and social problems such as air / water pollution, material failures, radioactive contamination, global environment problems, evacuation and so on.

We hope this conference will play a role of creating networks between academia and industries and push forward the technologies in those fields. ●

Follow GACM

10th GACM Colloquium on Computational Mechanics for Young Scientists from Academia and Industry

During September 10–13, 2023, the 10th GACM Colloquium on Computational Mechanics for Young Scientists from Academia and Industry, a regular conference of the German Association for Computational Mechanics (GACM), took place in Vienna, Austria. It was hosted at TU Wien and organized by three research associates from the faculties of Mechanical and Industrial Engineering and Civil and Environmental Engineering, namely Dr. Fabian Key, Dr. Marco De Paoli, and Dr. Antonia Wagner. As a highlight, the conference received the ÖkoEvent certificate from the City of Vienna, which recognizes sustainable events meeting several relevant criteria.

The event was well attended, with 170 participants from 15 countries around the world. In 17 mini-symposia with a total of 139 contributed talks, and a poster session with 12 contributions, researchers presented their latest work and advances in computational methods in engineering. In addition, the scientific program was enriched by five plenary lectures by renowned invited speakers presenting their cutting-edge research in computational mechanics, and the lecture of the GACM Best PhD Award 2022 winner, Dr. Ivo Steinbrecher.

Participants also enjoyed a variety of social activities, such as looking behind the scenes of the Natural History Museum, or exploring the main attractions of Vienna's central district during a riddle rally city tour. All in all, the diverse program and the lively participation of the members of the computational mechanics community in attendance made the event a great success.

Figure 1:
Natural History Museum Reception

Figure 2:
GACM President Marek Behr and the winners of the GACM Best Poster Award 2023, Annika Schmidt, Sonja Hellebrand, & Erik Faust

2nd German-Italian Workshop on Common Research Interests in Computational Mechanics

On September 14–15, 2023, the 2nd German-Italian Workshop on "Common Research Interests in Computational Mechanics", was organized by the Chair for Computational Analysis of Technical Systems at RWTH Aachen University. 35 experts from both countries came together for two days of knowledge exchange and collaboration.

Day one began with a guided tour of the awe-inspiring World Heritage Aachen Cathedral, setting the stage for the meeting. In the scientific program, we had a total of 19 talks in four sessions, addressing recent topics in computational mechanics. On both days, the scientific program headlined by keynote lectures. On the first day, Ferdinando Auricchio from Università di Pavia presented an overview of recent numerical methods applied to additive manufacturing. On the second day, Stefanie Elgeti from TU Wien and RWTH Aachen University, gave an inspiring presentation with the title "Numerical Design of Engineering Components and their Production

Figure 3:
35 experts from Germany & Italy

Processes". The evening dinner after the first day and coffee breaks on the Skylounge terrace on top of the RWTH main building fostered meaningful networking and connections.

Figure 4:
World Heritage
Aachen Cathedral

6th German-Japanese Workshop on Computational Mechanics

During December 4–5, 2023, the 6th German-Japanese Workshop on Computational Mechanics was organized also by the Chair for Computational Analysis of Technical Systems at RWTH Aachen University. It brought together 30 experts for two days of intense discussion.

The scientific program comprised a total of 18 talks in four sessions. On both days, the program featured keynote lectures. On the first day, Toshio Nagashima from Sophia University presented remarkable research on "Damage Propagation Analyses of CFRP Laminate with Impact Damage under Compressive Load by Quasi-3D XFEM". The second day was started by a motivating presentation "A Road Trip Report from Basic Science to Clinical Practice" by Wolfgang A. Wall from Institute for Computational Mechanics (Wall Lab) at Technical University of Munich. The dinner after the first day in Aachen city center gave a welcome occasion for networking and reviving long-lasting bonds between the two communities.

The workshop closed with a tour of the Jülich Supercomputer Center at Forschungszentrum Jülich. There, Dr. Andreas Lintermann gave an insight into the activities of European Center of Excellence RAISE. Afterwards, all participants had the chance to visit the high-performance computer systems JUWELS and the quantum annealing computer JUPSI at the Jülich UNified Infrastructure for Quantum Computing (JUNIQ).

Figure 5:
35 experts from Germany & Japan

Figure 6:
Excursion to the Quantum Annealear JUPSI,
FZ Jülich

*for all inclusions under **CEACM** please contact*
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URL: https://ceacm.net

The Central European Association for Computational Mechanics or **CEACM** counts the following Central European countries (in alphabetical order): Austria, Bosnia and Herzegovina, Croatia, Czech Republic, Hungary, Slovakia and Slovenia. The CEACM was created in 1990s by prominent scientists, Herbert Mang, former President of ECCOMAS and Ivo Babuska, a Gauss-Newton medalist of IACM. The Executive Committee of CEACM consists of the current President, Adnan Ibrahimbegovic, the Vice-President, Janos Logo, and the Past-President, Bernhard Pichler. The CEACM Board also includes: Pavel Polach, Justin, Murin, Joze Korelc,and Zdenko Tonkovic. It is CEACM Board that decides the attribution of CEACM Awards and the list of CEACM sponsored meetings.

In 2024, The CEACM Board has attributed three CEACM Awards to honor active researchers from CEACM partner countries. In particular, the senior scientists are honored by **CEACM Prof. Mang Award**, the highest honor by CEACM named after its founding father. The CEACM Prof. Mang Award is bestowed each year to honor an outstanding individual who has demonstrated sustained efforts in advancing either theoretical or practical aspects of computational mechanics and who provided strong leadership either in an academic environment or in different industrial applications. In 2024, the CEACM Prof. Mang award is attributed to Emeritus Professor of CTU Prague, *Zdenek BITTNAR* (*Figure 1*). The established researchers are honored by **CEACM Computational Mechanics Award**. This award recognizes a researcher who made significant contribution either in the traditional disciplines of Computational Mechanics or in related domains. This year, the CEACM Computational Mechanics Award is attributed to *Professor Ivica KOZAR* (*Figure 2*), University of Rijeka, Croatia. The **CEACM Young Researcher Award** was initiated by CEACM to honor an exceptional contribution of a young scientist, who has completed his/her doctoral studies in the broad domain of Computational Mechanics within the year of the award call. The winner this year is *Samir SULJEVIC* (*Figure 3*) of University of Sarajevo, Bosnia-Herzegovina. This thesis is also nominated by CEACM for participating in **ECCOMAS competition for Best Thesis Award**. All these CEACM Awards are attributed in the meeting of the CEACM Executive Board that was reunited on March 8, 2024 in online meeting (*Figure 4*).

Figure 1:
Zdenek BITTNAR
CEACM Prof. Mang Award

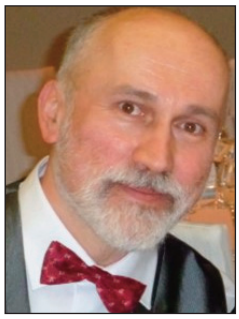

Figure 2:
Ivica KOZAR
CEACM Computational Mechanics Award

Figure 3:
Samir SULJEVIC
CEACM Best Thesis Award

The current scientific activities concern a CEACM sponsored scientific conference **S4ML**: *Synergy between Multiphysics/Multiscale Modeling and Machine Learning*, to be held in Prague, June 19-21, 2024. The main idea of this conference is to examine recent advances from mechanics and applied mathematics in a currently very active research domain of multi-scale modeling and computations in application to solids, fluids, structures, systems and different multi-physics problems. One of the motivations for this workshop is to investigate the complementarity of classical multi-physics/multi-scale approaches and model building approaches based on the use of machine learning algorithms. The knowledge accumulated through the long-term efforts of computational mechanics experts provides an a priori selection of efficient reduced models built with appropriate assumptions and kinematic constraints. Classical structural models are also proving to be very useful for building relevant multi-scale and multi-physics models. In parallel, there are many advances in the use of Artificial Intelligence and statistical data analysis algorithms, or machine learning approach to building models for mechanics. How can such approaches be developed in synergy? Can they benefit from each other's advances? Can model building skills be reduced to the application of artificial intelligence algorithms? It is an explicit goal of this thematic conference, in the true spirit of CEACM, to bring these different communities together, and thus provide a sound basis for a fruitful exchange of ideas among them. The conference seeks also to provide a platform for learning from some of the worlds' leading specialists coming from aerospace, civil and mechanical engineering, material science, and in the design and analysis of numerical algorithms from applied mathematics. For more detail, one can visit the conference website: **https://ceacm.net/s4ml-2024** ●

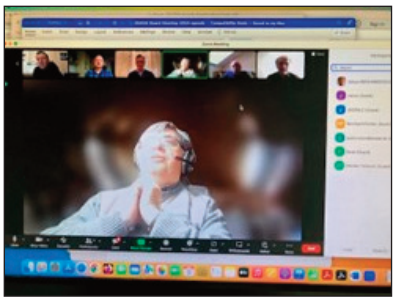

Figure 4:
CEACM Board Online Meeting, March 8, 2024

Gruppo Italiano di
Meccanica Computazionale

GIMC Best PhD Thesis Award

The The GIMC Best PhD Thesis Awards committee, composed by Stefania Cherubini (Politecnico di Bari), Ugo Galvanetto (Università di Padova), Antonio Madeo (Università della Calabria), Vincenzo Mallardo (Università di Ferrara) and Cristian Marchioli (Università di Udine), selected the following theses, defended in 2023, as the best Theses in Computational Solid and Fluid Mechanics:

- **Dr. Alessandro Marengo**, Politecnico di Milano
  "The phase-field modeling of fracture evolution in ductile materials with application to paperboard mechanics".
  This thesis was also selected as candidate for the ECCOMAS PhD Award

- **Dr. Alessandro Della Pia**, Università di Napoli Federico II
  "Numerical and experimental investigation of unsteady plane liquid jets"

GIMC SIMAI YOUNG 2024
Naples, July 10-12, 2024

GIMC (Gruppo Italiano di Meccanica Computazionale) and **SIMAI (Società Italiana di Matematica Applicata e Industriale)** are glad to announce that their second joint workshop for young scientists (≤ 35-year-old) will take place in Naples on July 10-12, 2024. This event aims to provide young researchers with a platform to exchange their most recent results, stay current on new trends, and foster meaningful interactions. The program includes some plenary lectures by leading scientists, a dedicated session for recipients of the GIMC-SIMAI young awards, parallel thematic sessions organized by participants, as well as contributed sessions.

All details can be found on the web site:
https://sites.google.com/view/gsyw24/home-page

GIMC GACM 2023 Workshop

The **German Association of Computational Mechanics (GACM)** and **GIMC** have organized the Second Joint GACM-GIMC workshop on *"Common Research Interests in Computational Mechanics"*. The workshop took place from September 14 to 15, 2023, at RWTH Aachen University, and was attended by invited members of the two associations to strengthen the collaboration between Italy and Germany in the broad field of Computational Mechanics.

Scientists from both countries who have initiated joint common research activities in the past and in recent times were asked to present their work resulting from the collaboration between the two countries.

The complete book of abstract can be downloaded from:
https://www.gacm.de/fileadmin/user_upload/gacmgimc2023/GACM-GIMC-Workshop-2023_BookOfAbstracts.pdf

The Web page with more information on the workshop is:
https://www.gacm.de/gacmgicm2023/organisation

5th Polish Congress of Mechanics & 25th International Conference on Computer Methods in Mechanics

From September 4 to 7, 2023, the 5th Polish Congress of Mechanics, combined with the 25th Conference of Computer Methods in Mechanics, took place at the Silesian University of Technology. The main organizer of the Congress was the Polish Association of Theoretical and Applied Mechanics, in particular the Gliwice branch, and the co-organizers were the Polish Association for Computational Mechanics and the Silesian University of Technology. The honorary patronage of this event was provided by the President of Poland. The following institutions provided substantive support: Institute of Fundamental Technological Research, Committees of the Polish Academy of Sciences and the Polish Scientific and Technical Exploitation Society. The city of Gliwice received the status of Event Partner.

During the opening ceremony of the Congress, the President of the Congress, prof. Michał Kleiber, Rector of the Silesian University of Technology prof. Arkadiusz Mężyk, President of the City of Gliwice Adama Neumann, Chairman of the Silesian Voivodeship Assembly prof. Mark Gzik, Chairman of the Polish Association of Theoretical and Applied Mechanics: prof. Tomasz Krzyżyński and the Chairman of the Polish Association for Computational Mechanics, prof. Wojciech Sumelka.




The Congress hosted 304 participants, and 225 works were presented. Invitations to give plenary lectures were accepted by: Prof. Marek Behr (Chair for Computational Analysis of Technical Systems (CATS), Center for Simulation and Data Science (JARA-CSD), RWTH, Aachen University), Prof. Piotr Breitkop (Department Laboratoire Roberval, FR3272 SHIC CNRS-UTC Alliance Sorbonne Université, Université de Technologie de Compiègne), Prof. Witold Elsner (Head of Department of Thermal Machinery, Faculty of Mechanical and Computer Engineering, Czestochowa University of Technology), Prof. Jerzy M. Floryan (Department of Mechanical and Materials Engineering, The University of Western Ontario), Prof. Andrzej Katunin (Silesian University of Technology, Faculty of Mechanical Engineering, Department of Fundamentals of Machinery Design), Prof. Kostyantyn Korytchenko (Head of Department of Applied Electrical Engineering, National Technical University "Kharkiv Polytechnic Institute"), Prof. Božidar Šarler (Chair of Department of Fluid Dynamics and Thermodynamics, Faculty of Mechanical Engineering, University of Ljubljana.), Prof. Wojciech Sumelka (Head of Division of Computer Aided Design, Poznan University of Technology), prof. Utz von Wagner (Chair of Mechatronics and Machine Dynamics, Technische Universität Berlin), Prof. Sebastian Wolf (Director of Movement Analysis Lab, Clinic for Orthopedics, Heidelberg University Hospital, Center for Orthopedics, Trauma Surgery and Spinal Cord Injury).

The Congress consisted of 7 thematic sessions, i.e. Solid Mechanics, Biomechanics, Fluid Mechanics, Solid Fluid Interaction, Computational Mechanics, Advanced Materials, Transdisciplinary Engineering and 12 mini-symposiums:

- MS04 – Damage identification in advanced materials.
  Organizers: S. Samborski, P. S. Valvo, D. Fanteria
- MS05 – Modern Mechanics of Concrete – Applications and Simulations.
  Organizers: J. Bobiński, S. Pietruszczak, M. A. Polak, A. Winnicki, A. Wosatko
- MS06 – Stochastic Mechanics.
  Organizers: A. Tylikowski, R. Iwankiewicz, Z. J. Zembaty, A. Ozga
- MS07 – Mechanism, machines and robots - theory and applications.
  Organizers: A. Burghardt, A. Harlecki, M. Wojtyra, J. Bałchanowski
- MS08 – Advanced discretization methods.
  Organizers: W. Cecot, W. Rachowicz, R. Sauer, G. Zboiński
- MS09 – Reliability of structures. Organizers: M. Dutkiewicz, J. Szafran

- MS10 – Vibration - Usage and Impact on the Environment.
  Organizers: G. Cieplok, M. S. Kozień
- MS11 – Multidisciplinary and Multi-science Modelling.
  Organizers: Y. Kwon, A. Poteralski, G. Dziatkiewicz
- MS12 – Dynamics of Structures. Organizers: P. Przybyłowicz, J. Warmiński
- MS13 – Computational Oncology and Personalised Medicine.
  Organizers: R. Białecki, E. Majchrzak MS14 – High Speed Phenomena.
  Organizers: J. Małachowski, K. Jamroziak, E. Krzystała, S. Sławski
- MS21 – Non-Conventional & Multi-Scale Methods for Solid & Fluid Mechanics.
  Organizers: W. Sumelka, T. Błaszczyk, Y. Sun, J. Leszczyński, G. Failla,
  Ł. Madej, S. Pfaller, P. Pańko, T. Wejrzanowski, K. Perzyński

Both plenary and thematic sessions were held in rooms in the Educational and Congress Center of the Silesian University of Technology building. The deliberations were held in 5 parallel sessions. The thematic scope of the Congress was extremely rich and diverse. It can be said that it basically completely covered the scientific and research issues of mechanics and computer methods in mechanics, with particular emphasis on the work currently being carried out, emphasizing new trends in science.

During the Congress, there were ceremonies honoring people for outstanding achievements in the field of science. During the opening of the Congress, the prof. O.C. Zienkiewicz Medal of the Polish Association for Computational Mechanics was awarded to prof. Marek Behr and prof. Witold Elsner. However, prof. Tomasz Krzyżyński accompanied by prof. Andrzej Tylikowski awarded the Prof. Wacław Olszak Medal to Dr. Eng. Katarzyna Szepietowska.

Special events accompanied the Congress. On the first day, the participants had the opportunity to listen to a concert of the Song and Dance Ensemble "Śląsk: im. Stanisław Hadyna". The twenty-two-person band performed in two versions: folk songs and stage songs. On the second day, congress participants were invited to take part in an extraordinary trip to the Guido Mine. It is a unique tourist attraction of Upper Silesia. On the third day, the "Gala Diner" took place on the Gliwice Aero Club's premises in the historic gliders exhibition hall. The gala dinner was celebrated with a concert of the Academic Music Ensemble of the Silesian University of Technology.




State institutions and private companies also got involved in the event through financial support. The event received funding under the "Excellent Science" program. The Diamond Sponsor status was awarded to AIUT and DANTEC DYNAMICS, the Gold Sponsor status was awarded to X-SIGHT, Sumitomo and EC TEST SYSTEMS, and the Silver Sponsor status was awarded to EMT SYSTEMS - Engineering Training Center. The support provided contributed to maintaining the highest organizational standards, which resulted in the Congress being a substantive and organizational success.

Organizing the Congress was challenging, demanding, and engaging for many months. However, the success achieved would not be possible without the support of many people. Therefore, we would like to thank everyone for their involvement, together with the Organizing Committee, in organizing this event, which is so important for the mechanics community in Poland. ●

by:
Sławomir Duda & Wojciech Sumelka

The ABMEC (Brazilian Association of Computational Methods in Engineering) aims to promote the appreciation and dissemination of knowledge achieved by researchers in the area of Computational Methods applied to Engineering. The events sponsored by ABMEC over the years have significantly represented these objectives, reaching the target audience in a differentiated manner each year.

2nd German Brazilian Workshop on Computational Mechanics

Figure 1:
2nd German Brazilian Workshop Delegate Group Photo

The 2nd German Brazilian Workshop on Computational Mechanics took place at TUHH Hamburg University of Technology from Nobember 9th to 11th 2023.

The workshop brought together scientists in order to exchange experiences and knowledge as well as to explore possible cooperations and to build up a large network of Brazilian and German researchers. The event strengthened the cooperation with many vivid discussions.

CILAMCE 2023

The hosting of CILAMCE 2023 in Porto, Portugal, organized by FEUP and ISEP, promoted by the Brazilian Association of Computational Mechanics (ABMEC), was a milestone in the dissemination of research, exchange of ideas, networking, and human resource development in research.

Figure 2:
Opening ceremony at CILAMCE 2023

The event brought together researchers, students, professors, and professionals from various areas of Computational Mechanics, offering a unique opportunity for knowledge sharing and experiences. A total of 275 people attended the event, including 136 delegates, 11 graduate students, and 28 undergraduate students. 260 papers were presented on relevant topics for the field, such as numerical modeling, simulation and analysis of structures, software development, among others.
The networking promoted by CILAMCE 2023 was also of great importance for human resource development in research. Participants had the opportunity to meet other people in the field, establish professional and academic contacts, and even seek internship or job opportunities.

In this way, ABMEC's promotion of CILAMCE in 2023 in Porto significantly contributed to the dissemination of research in the field of Computational Mechanics, the exchange of ideas and networking among researchers and institutions, and the development of human resources in research.

ABMEC reaffirms its commitment to the promotion and development of Computational Mechanics in Brazil and worldwide and looks forward to continuing to hold events like this in the future.

ABMEC Awards

At the CILAMCE conference banquet, the ABMEC awards were presented: Dr. Diego Hayashi Alonso won the ABMEC Award for Best Doctoral Thesis of the Year and ABMEC Young scientist Award was given to Dr. Americo Barbosa da Cunha Junior.

Figure 3:
ABMEC Awards Presentation

Activities in 2024

From March 25th to 27th, 2024, the 1st Edition of the Workshop on Computational Mechanics in Petroleum and Energy (MeComPE 2024) took place at the Institute of Research in Petroleum and Energy (i-LITPEG), on the Recife Campus of UFPE.
The workshop is organized by the High-Performance Processing Group in Computational Mechanics (PADMEC), under the auspices of the Brazilian Association of Computational Methods in Engineering (ABMEC). It aims to strengthen the synergy between academia and industry, thereby improving the dissemination and understanding of actions developed by the university and the private sector.

The main objective of this event is to create a forum for debate and dissemination of knowledge and innovation, where professors, researchers, professionals, and students can exchange ideas and information about computational methods and systems, as well as technological advances employed in solving theoretical and practical problems in engineering and applied sciences in the field of petroleum and energy.

ABMEC is pleased to announce that CILAMCE will be held in the city of Maceió/AL, organized by our colleagues from the Federal University of Alagoas (UFAL). ABMEC will be promoting the event in a joint organization with the Laboratory of Scientific Computing and Visualization (LCCV) and the Postgraduate Program in Civil Engineering (PPGEC), institutions that are part of the Technology Center (CTEC), of the Federal University of Alagoas (UFAL) and the logistical support from Maceió Convention & Visitors Bureau, foundation who works for the development of the tourist trade in Alagoas.

This is a great opportunity for our researchers and associates to participate in an event of international relevance, with the presence of important names in the field, and to present their work to a qualified audience.

Additional information about the conference can be found at **www.cilamce.com.br**

The Computational Structural Mechanics Association

The Computational Structural Mechanics Association (CSMA) federates the French structural engineering community and, since 1993, has organized the national structural engineering symposium on the Giens peninsula in the Var region of France. The symposium brings together over 350 researchers, theoreticians, numerologists, software developers, and industrialists to review the state of the art in the field's main lines of research and emerging themes.

The 2024 edition will take place from **May 13 to 17, 2024**. A "young" laboratory organizes it: the LMPS - Laboratoire de Mécanique Paris-Saclay - is a Joint Research Unit (UMR 9026) of the University of Paris-Saclay, CentraleSupélec, ENS Paris-Saclay and CNRS. Created from the fusion of the Laboratoire de Mécanique et Technologie (LMT) and the Laboratoire de Mécanique des Sols, Structures et Matériaux (MSSMat), it was officially established on January 1, 2022. The LMPS is also supported by SafranTech, which today accounts for 1/4 of the Safran Group's Research & Technology effort.

LMPS Laboratoire de Mécanique Paris-Saclay

SAFRAN

Organisation

Head of the Organising Committee:

- Chairman: *Pierre-Alain BOUCARD*, LMPS, Paris-Saclay
- Vice-Chairman: *Frédéric FEYEL*, SafranTech & LMPS, Paris-Saclay

Scientific Committee

- President: *Paco CHINESTA*, Arts et Métiers, Paris
- Vice-Presidents: *Philippe BARABINOT*, Siemens Digital Industries Software, *Châtillon Didier CLOUTEAU*, CentraleSupélec, Gif-sur-Yvette

Congress Themes

The themes of the CSMA community will be addressed during the conference:

- Statics and Dynamics of Structures: beams, plates, shells, composite structures, civil engineering structures, instabilities, vibrations of structures, rapid dynamics, vibro-acoustics, nanosystems
- Lifespan of Structures: fatigue, damage, cracking, fracture
- Mechanics of Contact, Interfaces: friction, thin layers, methods and models for contact, imperfect interfaces
- Numerical Methods: resolution and discretization techniques, model coupling, multi-scale methods, X-FEM, DEM, MAN, data sciences for mechanics, optimization
- Biomechanics and Engineering of the Living: biomaterials, biomimicry

- Models and Material Behavior: plasticity, viscoelasticity, viscoplasticity, damage, instabilities, multi-scale methods, multi-physical couplings, identification, inverse methods
- Engineering Augmented by data, learning and AI:
- Numerical simulation and Data science in automotive mechanics
- Numerical, mathematical and physical approaches to multi-scale problems: from discrete to continuous

Plenary Sessions

- *Laura de LORENZIS*, ETH Zürich, Switzerland.
  "Machine learning for solving PDEs in solid mechanics: many issues and a few solutions."
- *Olivier ALLIX*, LMPS, ENS Paris-Saclay, France.
  "A Swiss Army knife for coupling: non-intrusive approaches."
- *Florence BERTAILS-DESCOUBES*, INRIA Grenoble Rhône-Alpes, France.
  "Numerical modeling of contacting fibers for cinema, inverse design of structures, and physical exploration."
- *Eric LAROUR*, JPL, California Institute of Technology, USA.
  "To what extent can we predict sea-level rise by 2150?"
- *Marie JACQUESSON*, CNES, Head of Thermal Structures and Materials for Space Transport at the Technical and Digital Launchers Directorate.
  "Space transport of tomorrow: system and technological challenges for structures."
- *Ludovic STUMME*, NAVAL GROUP, Head of Simulation Activity Sector, Head of Calculation Simulation Domain, Senior Expert in Naval Combat Simulation.
  "From Digital Twins to Engineering 4.0: a passing trend or a necessary evil?"

CSMA Junior

In 2016, the CSMA association saw the creation of a section of young researchers called CSMA Juniors. This section, targeting CSMA members under the age of 40 (PhD students, post-docs, junior permanent staff) has various objectives in line with the strong dynamism of the CSMA association. The CSMA 2024 congress will be followed by a junior workshop on the island of Porquerolles from May 17 to 19, 2024. ●

conference diary planner

13 m- 17 May 2024	**CSMA 2024 – 16ème colloque national en calcul des structures**		
	Venue: Giens, France	*Contact:*	https://csma2024.sciencesconf.org/
3 - 7 June 2024	**9th European Congress on Computational Methods in Applied Sciences and Engineering**		
	Venue: Lisbon, Portugal	*Contact:*	https://eccomas2024.org/,
18 - 21 June 2024	**7th ITC – International Conference on Geoetechnical and Geophysical Site Characterization**		
	Venue: Barcelona, Spain	*Contact:*	https://eccomas2024.org/
19 - 21 June 2024	**CEACM / S4ML - Synergy between Multiphysics/Multiscale Modeling and Machine Learning**		
	Venue: Prague, Czechia	*Contact:*	https://ceacm.net/s4ml-2024
21 - 26 July 2024	**WCCM/PANACM - 16th World Congress on Comp Mechanics & 4th PANACM Congress**		
	Venue: Vancouver, Canada	*Contact:*	https://www.cacse-accsg.ca/
12 - 14 Aug 2024	**Second Thematic Conference on Uncertainty Quantification for Machine Learning Integrated Physics**		
	Venue: Arlington, Virginia	*Contact:*	https:/www.usacm.org
2 - 6 Sept 2024	**II Congresso AIMETA 2024**		
	Venue: Napoli, Italia	*Contact:*	https://www.aimeta.it/index.php/notizie/243-congresso-aimeta-2024
3 - 5 Sept 2024	**DyCOMP2024/ECCCS3 - International Conference on the Dynamic Behaviour of Composites – DyCOMP and European Conference on Crashworthiness of Composite Structures – ECCCS**		
	Venue: Sicily, Italy	*Contact:*	https://dycomp2024.cimne.com/
27 - 30 Oct 2024	**IGA 2024**		
	Venue: St. Augustine, Florida	*Contact:*	https:/www.usacm.org
5 - 8 Nov 2024	**MECOM 2024 - XL Argentine Congress on Computational Mechanics**		
	Venue: Rosario, Argentina	*Contact:*	https://amcaonline.org.ar/mecom2024/
26 - 29 May 2025	**COUPLED 2025 - XI International Conference on Coupled Problems in Science and Engineering**		
	Venue: Sardinia, Italy	*Contact:*	https://coupled2025.cimne.com/
9 - 11 June 2025	**ADMOS 2025 - XII International Conference on Adaptive Modeling and Simulation**		
	Venue: Barcelona, Spain	*Contact:*	https://eccomas2024.org/
23 - 27 June 2025	**MARINE 2025 - XI International Conference on Computational Methods in Marine Engineering**		
	Venue: Edinburgh, Scotland	*Contact:*	https://eccomas2024.org/
1 - 4 July 2025	**COMPSAFE2025 - 4th Computational Engineering & Science for Safety & Environmental Problems**		
	Venue: Kobe, Japan	*Contact:*	https://eccomas2024.org/
2 - 5 Sept 2025	**COMPLAS 2025 - XVIII Int Conference on Computational Plasticity**		
	Venue: Barcelona, Spain	*Contact:*	https://complascourse2025.cimne.com/
9 - 11 Sept 2025	**Sim-AM 2025 - The Fifth International Conference on Simulation for Additive Manufacturing**		
	Venue: Pavia, Italy	*Contact:*	https://sim-am2025.cimne.com/
14 - 17 Sept 2025	**IGA 2025 -13th International Conference on Isogeometric Analysis**		
	Venue: Barcelona, Spain	*Contact:*	https://particles2025.cimne.com/
20 - 22 Oct 2025	**PARTICLES 2025 - IX International Conference on Particle-based Methods**		
	Venue: Brisbane, Australia	*Contact:*	https://web.aeromech.usyd.edu.au
7 - 10 Dec 2025	**9th APCOM 2025 - Asia Pacific conference on Computational Mechanics**		
	Venue: Brisbane, Australia	*Contact:*	https://web.aeromech.usyd.edu.au/ACCM2013/AACM/