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EUROMECH Conference Reports 2025

12th European Solid Mechanics Conference (ESMC12)

Lyon, 7–11 July 2025

Chair: Prof. Eric Maire

Co-Chair: Prof. Samuel Forest

Introduction

The 12th European Solid Mechanics Conference (ESMC2025) was held at the Lyon Convention Center, Lyon, France, from 7 to 11 July 2025. The conference website is esmc2025.sciencesconf.org. The conference was chaired by Prof. Eric Maire (MATEIS laboratory, INSA Lyon), with Prof. Samuel Forest (Mines Paris PSL) as co-chair. The French Organising Committee comprised 35 distinguished researchers in Solid Mechanics, who contributed to the setting up of the 46 Mini-Symposia and other events.

Scientific Program Highlights

The conference programme followed the tradition of previous recent ESMCs: five days (7–11 July) with one lunch break and two coffee breaks per day. Six plenary lectures were delivered over the week (one cancelled), including two EUROMECH Solid Mechanics Prize Lectures by G. Holzapfel (opening lecture) and V. Deshpande, introduced by Anna Pandolfi, Chair of the Solid Mechanics Prize and Fellow Committee.

The conference had one General Session (GS) dedicated to Structural Mechanics, and 46 Mini-Symposia (MS) belonging to eight scientific topics and involving 120 MS organisers. 19 rooms were used for parallel GS and MS sessions, with up to 13 two-hour sessions per room over the course of the week. A poster session (61 posters) took place on Monday evening in the Forum, followed by a Wine and Cheese party and a concert by the famous INSA Lyon mechanics and materials rock band.

The conference was opened on 7 July 2025 by the Conference Chair Eric Maire, Ida Raoult (Head of Mecamat and Safran sponsor representative), and Marc Geers (EUROMECH Vice-President). The EUROMECH Solid Mechanics Fellows certificates were distributed among 5 new fellows: Profs. Peter McHugh (Ireland), Jean-François Molinari (Switzerland), Ron Peerlings (The Netherlands), Elio Sacco (Italy), and Jörg Schröder (Germany), in a ceremony chaired by Samuel Forest (EUROMECH Secretary General) and Anna Pandolfi.

Notable innovations at ESMC2025 included: (1) the Come by Train Award, distributing 300 chocolate bars from a Lyon chocolaterie to participants arriving by train — 315 participants travelled 150,000 km by train, saving more than 38 tonnes of CO₂; (2) a session on Scientific Publishing in 2025; (3) a Postdoc and PhD Student Networking and Mentorship Session with 180 students and 11 professor mentors; (4) a social science experiment with 150 volunteers; and (5) an exhibition of 20 portraits of Women in Science.

Young Research Award winners:

- first oral presentation prize to Manon Thébaud (École polytechnique, France) and
- second prize to Irina-Malina Strugaru (IST Austria).
- Best poster prizes to
 - Mahmoud Ashour (Robert Bosch GmbH / Arts et Métiers ParisTech, France),
 - Nikolaos Rogkas (NTUA, Greece), and
 - Polina Kabanova (IPME RAS, Russia).

Organization

The conference was supported by the European Solid Mechanics Conference Committee (ESMCC), chaired by Professor Claudia Comi, and the EUROMECH Officers. It was hosted at the Lyon Convention Center,

close to the Parc de la Tête d'Or along the Rhône river. Plenary lectures took place in the Amphithéâtre Lumière (700 seats). The conference engaged the services of INSAVALOR and the Lyon Convention Center for practical organisation. The Conference Dinner was held at Les Subsistances, Lyon, with 650 attendees.

Key statistics:

- Participant registrations: 1,402
- Student registrations: 50% (536 PhD + 170 postdocs)
- Submitted abstracts: 1,320
- Papers presented: 1,100
- Countries represented: 54
- Participants from outside Europe: 20%
- General session: 1; Mini-Symposia: 46; MS organisers: 120; Parallel sessions: 19

Conclusion

The many positive reactions received during and after the conference indicate that ESMC 2025 has been a real success for the European Solid Mechanics community. The success in terms of participation and scientific discussions demonstrates the strength of the European community and, in particular, of the French community in mechanical sciences. A recommendation for future EUROMECH conferences is to continue supporting the involvement of women in science and the participation of young researchers. The next ESMC (ESMC13) will be held in Louvain-la-Neuve, Belgium, chaired by Nicolas Moës and Aude Simar.

EUROMECH Colloquia Reports 2025

EUROMECH Colloquium 629

Data-driven fluid mechanics

2–4 April 2025, London, UK

Chairperson: Dr Luca Magri

Co-Chairperson: Dr Georgios Rigas

Introduction

Data-driven methods are rapidly reshaping the landscape of fluid mechanics, offering new paradigms for modelling, prediction, and control. This EUROMECH Colloquium brought together leading researchers to discuss state-of-the-art methods and open challenges at the interface of data science, machine learning, and fluid dynamics. The event was held at Imperial College London and attracted 242 participants from 20 countries.

Scientific Program Highlights

The colloquium was structured around three main thematic areas: data-driven modelling and reduced-order methods, machine learning for turbulence and transition, and reinforcement learning for flow control. Keynote speakers and contributed talks covered a wide spectrum of approaches including physics-informed neural networks, sparse identification of nonlinear dynamics (SINDy), spectral proper orthogonal decomposition (SPOD), and operator-based methods for resolvent analysis.

Particular attention was given to challenges in applying machine learning to high-dimensional turbulent flows, the interpretability of deep learning models, and the integration of physical constraints into data-driven architectures. Emerging themes included hybrid models combining first principles with data, uncertainty quantification, and the use of large language models in scientific computing.

Sessions on flow control demonstrated the potential of reinforcement learning and closed-loop strategies for drag reduction and separation control, with several contributions reporting significant performance improvements over classical methods. The poster sessions were particularly lively, with 242 attendees from academia and industry.

Organization

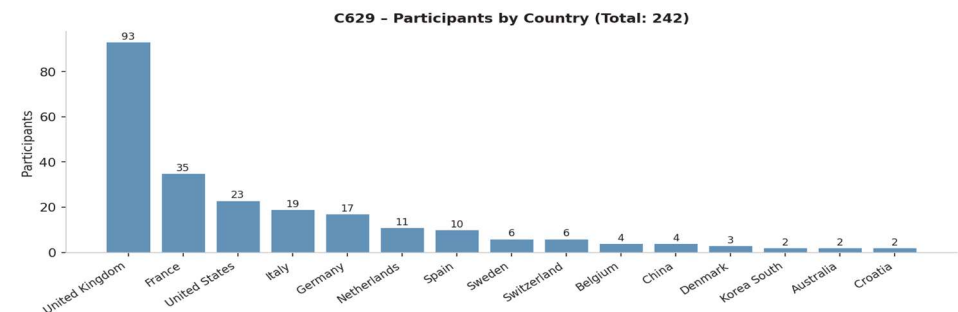
The colloquium was held over three days (2–4 April 2025) at Imperial College London. Registration fees ranged from 420 EUR (early-bird PhD students) to 700 EUR (late registration). Participants were offered lunches, a drinks reception, invited talks, panel sessions, and networking events. No additional external funding was obtained.

Number of EUROMECH members: 34

Total participants: 242 (from 20 countries)

Conclusion

EUROMECH Colloquium 629 successfully consolidated a growing community working at the frontier of data science and fluid mechanics. The breadth of topics and the quality of interactions confirmed that data-driven approaches are now central to the field. The organisers thank EUROMECH for its support.



EUROMECH Colloquium 647

Stability and bifurcation problems in nonlinear solid mechanics

23–25 April 2025, Glasgow, UK

Chairperson: Dr Prashant Saxena

Co-Chairperson: Prof. Silvia Budday

Introduction

Stability and bifurcation in nonlinear solid mechanics have long been central themes in understanding the limits of material and structural performance. Traditionally, instabilities such as wrinkling, creasing, buckling, and fracture were viewed as precursors of failure. However, recent developments in materials science, biomechanics, and soft robotics have revealed that these phenomena may also be exploited as functional mechanisms for novel design. This Colloquium brought together leading experts in theory, computations, and experimentation to consolidate the state of the art, stimulate new ideas, and chart future directions in this rapidly evolving field.

The Colloquium took place from 23–25 April 2025 at the University of Glasgow, UK. It was organised in a single-stream format to maximise interaction and foster discussions across communities. In total, there were 22 presentations and ample time and opportunities for informal discussions. The event attracted a diverse mix of researchers across Europe, North America, and Asia, with strong participation from both early-career and established scientists.

Scientific Program Highlights

The scientific programme was organised around four key themes: biomechanics and morphogenesis; wrinkling, creasing and surface instabilities; multiphysics coupling in soft active materials; and numerical methods and reduced-order models.

In biomechanics and morphogenesis, Silvia Budday (Erlangen-Nuremberg) demonstrated how mechanical instabilities translate cellular-scale processes into organ-level patterns in the human brain. Davide Ambrosi (Milan) presented rod models for cardiovascular mechanics, capturing the essence of mitral valve dynamics and arterial morphogenesis. Philip Bayly (Washington University) analysed ciliary axonemes using a multifilament model, proposing flutter-like mechanisms for oscillations. Jiong Wang (Guangzhou) and Mingchao Liu (Birmingham) addressed shape control in soft material systems driven by differential growth.

In surface instabilities, Prashant Saxena (Glasgow) presented incremental stability analysis of layered magnetoelastic half-spaces. Valentina Balbi (NUI Galway) reported on wrinkling of auxetic bilayers under uniaxial tension. Yibin Fu (Keele) presented a reduced nonlinear model for hyperelastic layers. Contributions by Draga Pihler-Puzovic (Manchester) and Sushma Santapuri (IIT Delhi) further explored wrinkling-based patterning and active control of instabilities in electro/magneto-active thin sheets.

In multiphysics, talks by Massimiliano Gei (Trieste), Stephan Rudykh (NUI Galway), Kostas Danas (CNRS Paris), and Daniel Garcia-Gonzalez (Madrid) explored magnetoactive composites and dielectric elastomers, showing how tailored microstructures can be harnessed to tune instabilities. A theme of "buckliphilia" — exploiting instabilities as design opportunities — emerged as a unifying philosophy.

Numerical contributions from Andrew McBride, Lukasz Kaczmarczyk (Glasgow), Marcelo Dias (Edinburgh), Atul Bhaskar (Southampton), Gilad Yakir (EPFL), and Daniil Yurchenko (Southampton) highlighted advances in isogeometric analysis, mixed finite element formulations, and bifurcation analysis of non-smooth systems.

Organization

The Colloquium was hosted by the James Watt School of Engineering, University of Glasgow, which provided funding for all local arrangements including venue hire and subsistence for 2.5 days. Registration was free for all participants. Participants were offered subsistence (lunch, coffee, snacks) during the three days and a drinks reception. The hybrid format accommodated two online presentations from colleagues unable to travel.

Conclusion

The Colloquium achieved its aims of consolidating the state of the art, highlighting new directions, and strengthening connections across communities working on stability and bifurcation in nonlinear solid mechanics. Feedback from participants was overwhelmingly positive, praising both the scientific content and the organisation. The organisers thank EUROMECH for its support and the University of Glasgow for hosting this stimulating event.

EUROMECH Colloquium 650

Addressing Challenges in Applied Mechanics through Artificial Intelligence Applications

27–29 August 2025, Belgrade, Serbia

Chairperson: Prof. Nataša Trišović

Co-Chairpersons: Prof. Tamás Mankovits, Dr Petar Dimitrov, Prof. Zoltán Major, Dr Ana Petrović

Introduction

Artificial intelligence is rapidly transforming applied mechanics, enabling new approaches to modelling, simulation, and design optimisation in mechanical and structural systems. EUROMECH Colloquium 650 was designed to explore the integration of AI methods with classical mechanics, bringing together researchers from Eastern and Western Europe as well as further afield. The colloquium was held in Belgrade, Serbia, and attracted 77 participants from 20 countries.

Scientific Program Highlights

The programme covered a wide range of topics at the interface of artificial intelligence and applied mechanics. Sessions addressed the use of neural networks and deep learning for constitutive modelling, finite element enrichment, and structural health monitoring. Machine learning approaches for damage detection, vibration analysis, and fatigue prediction were presented, alongside data-driven methods for fluid-structure interaction.

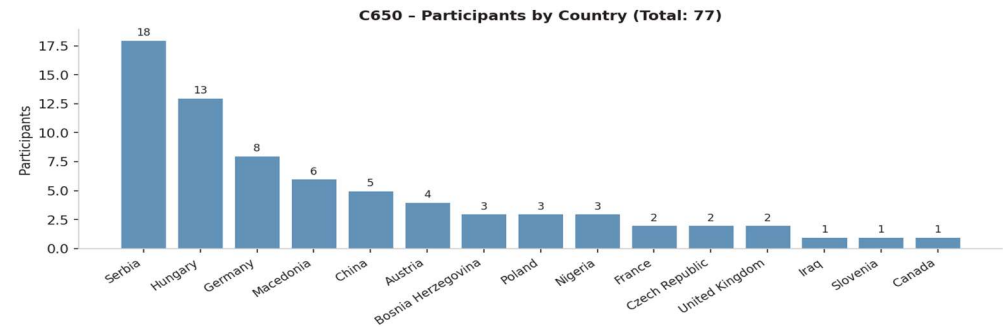
Contributions from industry and academia highlighted practical applications including topology optimisation with AI, digital twin technology, and AI-assisted design of mechanical components. Discussions on the reliability and interpretability of AI models in safety-critical engineering contexts were particularly engaged, reflecting the community's awareness of deployment challenges.

Organization

The colloquium was held over three days (27–29 August 2025) at the University of Belgrade, Serbia. Registration fees ranged from 100 EUR (student early bird) to 300 EUR (late registration). The 77 participants came from 20 countries, with the largest delegations from Serbia (18), Hungary (13), and Germany (8).

Conclusion

EUROMECH Colloquium 650 successfully convened an interdisciplinary community working at the frontier of AI and applied mechanics. The diversity of participants and topics confirmed the broad relevance of machine learning methods across engineering disciplines. The organisers thank EUROMECH for support and the University of Belgrade for hosting.



EUROMECH Colloquium 651

Films, bubbles, droplets and phase change

25–29 August 2025, Metz, France

Chairperson: Pr. Michel Gradeck

Co-Chairpersons: Pr. Alidad Amirfazli, Dr. Stéphane Dorbolo

Introduction

Thin liquid films, bubbles, droplets, and phase-change phenomena are ubiquitous in industrial processes, environmental systems, and biological applications. EUROMECH Colloquium 651 was co-located with the French Mechanics Congress (CFM2025) in Metz, France, providing participants with an enriching broader scientific context. The event drew 33 participants from 9 countries.

Scientific Program Highlights

After a short opening session, six thematic sessions were organised: industrial issues (chaired by Pr. A. Amirfazli), film dynamics and stability, droplet impact and spreading, phase-change and boiling, interfacial instabilities, and complex fluids near interfaces. The programme included invited plenary lectures by Gretar Tryggvason (Johns Hopkins University) and other distinguished researchers, covering topics from wetting dynamics to pool boiling enhancement.

Talks addressed a wide range of fundamental and applied problems including: thin film rupture, Leidenfrost drops, droplet impact on rough surfaces, condensation in microchannels, Marangoni-driven flows, and the mechanics of foams. Numerical approaches ranging from Volume of Fluid to lattice Boltzmann methods were presented alongside experimental studies using optical diagnostics and infrared thermography.

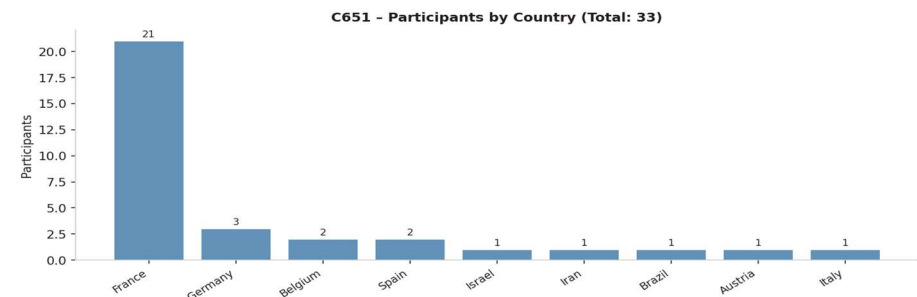
A highlight was the opening joint plenary session at the CFM conference, open to all attendees, followed by a Welcome Cocktail at the Robert Schuman Convention Centre.

Organization

The colloquium ran from 25 to 29 August 2025 in Metz, France. Registration fees were 480 EUR (senior, early bird) and 300 EUR (PhD student, early bird), excluding VAT. Additional funding of 1,000 EUR was received from LEMTA Laboratory, and the CNRS network TRANSINTER sponsored the conference dinner. The University of Lorraine covered travel and accommodation for one co-chair and one plenary speaker. Participants received coffee breaks, lunches, a gala dinner at the stadium of Metz, a dinner at restaurant El Theatris, a visit to the ArcelorMittal research centre, and a free public transport pass for Metz.

Conclusion

EUROMECH Colloquium 651 provided an excellent forum for specialists in interfacial flows and phase change to exchange results and ideas. The co-location with CFM2025 enriched the programme and broadened interactions. The organisers gratefully acknowledge the support of EUROMECH, LEMTA Laboratory, TRANSINTER, and the University of Lorraine.



EUROMECH Colloquium 652

Non-spherical particles in turbulence: recent advances in theory, simulation and experiments

16–18 July 2025, Udine, Italy

Chairperson: Prof. René van Hout

Co-Chairperson: Prof. Cristian Marchioli

Introduction

Non-spherical particle–turbulence interactions are common in many environmental, technological and biological applications. In some cases these particles can be modelled as spherical, but in many others — such as microplastics dispersion, ice crystals in the atmosphere, and composite material fabrication — the non-sphericity and associated alignment govern the dispersion, light reflection, or material strength. This colloquium reviewed the state of the art and identified open challenges in the field.

The colloquium was held at the University of Udine, Italy, from 16 to 18 July 2025, and brought together 39 specialists from 16 countries, combining both EUROMECH members and non-members.

Scientific Program Highlights

The programme covered theoretical, numerical, and experimental advances in understanding how non-spherical particles — including fibres, rods, disks, and irregular shapes — interact with turbulent flow structures. A key focus was on preferential sampling of flow regions characterised by specific values of velocity gradient tensor invariants, which governs the orientation distributions and translational/rotational dynamics of non-spherical particles.

Keynote and invited contributions addressed direct numerical simulations of particle-laden turbulence at high Reynolds numbers, novel experimental

techniques using 3D-PTV and holographic approaches, and Lagrangian tracking models for realistic particle shapes. Emerging topics included particle dynamics in non-Newtonian carrier fluids, interactions with wall structures in turbulent channels, and biological applications involving swimming micro-organisms and red blood cells.

Discussions highlighted the need for benchmark databases for non-spherical particle dynamics and called for improved two-way coupling models that are computationally affordable at industrially relevant particle concentrations.

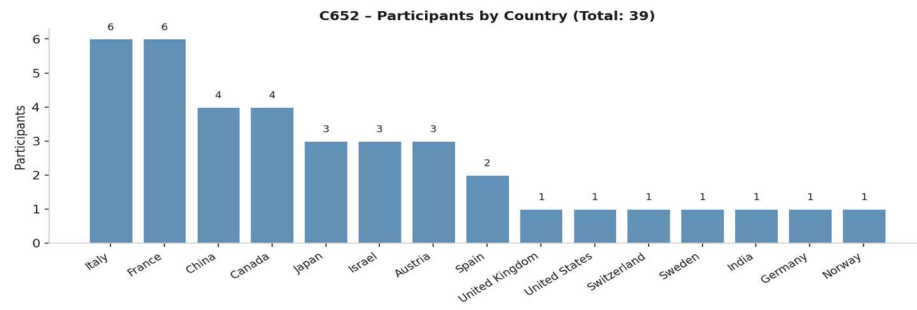
Organization

The colloquium was supported by 2,000 EUR from the University of Udine for conference materials and printing. Registration included printed scientific programme, stationery, 5 coffee and tea breaks, 3 lunches, a welcome cocktail, pizza dinner, and the gala dinner. Online attendees received an electronic book of abstracts. Registration fees ranged from 300 EUR (early bird PhD students) to 750 EUR (late/onsite).

Total participants: 39 (from 16 countries)

Conclusion

EUROMECH Colloquium 652 brought together an active community and successfully defined open problems and promising research directions for non-spherical particle dynamics in turbulence. The organisers thank EUROMECH and the University of Udine for their support.



EUROMECH Colloquium 653

Mechanics of interfaces

26–28 August 2025, Metz, France

Chairperson: Dr. Stéphane Berbenni

Co-Chairpersons: Dr. Katarzyna Kowalczyk-Gajewska, Dr. Remi Dingreville

Introduction

Interfaces such as grain boundaries in polycrystalline materials and heterointerfaces in multiphase systems are ubiquitous in the mechanics of materials, governing a wide range of properties and applications. Understanding the role of interfaces is key in optimising metals, alloys, ceramics, and composites for electrochemical energy conversion and storage, optical, magnetic, thermomechanical, and environmental applications.

EUROMECH Colloquium 653 gathered scientists from mechanical sciences, materials science, and physics to present recent developments in interface mechanics, covering scales from atomistic to continuum. The colloquium was held in Metz, France, co-located with CFM2025 (French Mechanics Congress), with 45 participants from 10 countries.

Scientific Program Highlights

The programme addressed: dislocation-interface interactions and grain boundary mechanics; phase field and crystal plasticity modelling of interface-governed deformation; atomistic and mesoscale simulations of grain boundary migration and segregation; experimental characterisation of interfaces by X-ray diffraction, EBSD, and TEM; and fracture and fatigue at interfaces.

A strong theme was the multiscale nature of interface mechanics: contributions spanned from first-principles calculations of grain boundary energy and mobility (Mordehai, Stinville) to macroscopic crystal plasticity frameworks accounting for interface resistance (Berbenni, Forest, Lebensohn). The role of solute segregation and precipitation at grain boundaries in governing creep and fatigue resistance received particular attention.

Presentations on heterointerfaces in composites and multilayers explored how interface geometry and chemistry influence load transfer, fracture toughness, and thermal conductivity. Computational advances included novel phase-field models for grain boundary migration with realistic mobility functions, and reduced-order models for polycrystal plasticity incorporating grain boundary mechanisms explicitly.

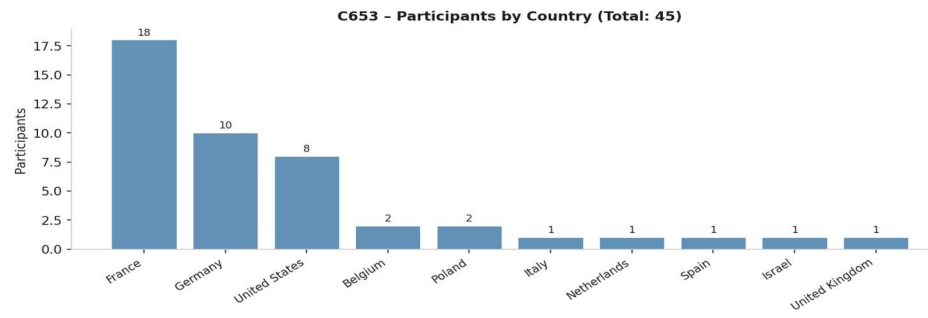
Organization

The colloquium ran from 26 to 28 August 2025 in Metz, France. Registration fees were 480 EUR (senior, early bird) and 300 EUR (PhD student, early bird). Additional funding was received jointly with CFM2025. Participants received four lunches, daily coffee breaks, a welcome cocktail at the Convention Centre, and dinner at restaurant El-Theatris in Metz.

Total participants: 45 (from 10 countries, including France 18, Germany 10, United States 8)

Conclusion

EUROMECH Colloquium 653 provided a focused forum for the community working on interface mechanics, facilitating exchanges between experimentalists, modellers, and simulators. The co-location with CFM2025 was highly beneficial. The organisers thank EUROMECH, LEM3, and the CFM2025 organisation for their support.



EUROMECH Colloquium 654

Bio-inspired Fluid-Structure Interaction

9–11 July 2025, Vienna, Austria

Chairperson: Dr Chandan Bose, Dr Manuel Garcia-Villalba

Co-Chairpersons: Dr Marco de Tullio, Dr Oscar Flores, Dr Ramiro Godoy-Diana

Introduction

The EUROMECH 654 Colloquium on "Bio-inspired Fluid-Structure Interaction" was held from 9 to 11 July 2025 in Vienna, Austria, bringing together leading researchers from around the world to advance the understanding of how biological systems interact with fluid flows and inspire engineering solutions. The colloquium featured 38 presentations across 10 sessions, with participants from Europe, North and South America, Asia, and Australia. In addition to regular talks, two open discussions were held on FSI solver benchmarking and data availability and dissemination.

Scientific Program Highlights

The colloquium addressed a diverse range of research topics, demonstrating the interdisciplinary nature of bio-inspired fluid-structure interaction. Presentations were organised into several key thematic areas.

Bio-inspired engineering applications dominated the programme with 11 presentations, exploring applications ranging from Martian exploration aircraft to underwater robots and emphasising the versatility of bio-inspired approaches. A significant portion of the programme was devoted to insect and bird flight — 8 presentations — using high-fidelity simulations and experimental methods to understand unsteady aerodynamics and to inspire micro-air vehicle design.

Aquatic locomotion received 7 presentations covering fish swimming, undulatory locomotion, and energy harvesting from bluff-body wakes. Flexible structure dynamics — 6 presentations — addressed the interplay between flexibility, passive shape adaptation, and fluid loading in biological and engineering systems. Five additional presentations explored plant biomechanics and poroelastic media, covering topics from algae reconfiguration in currents to seed dispersal mechanics.

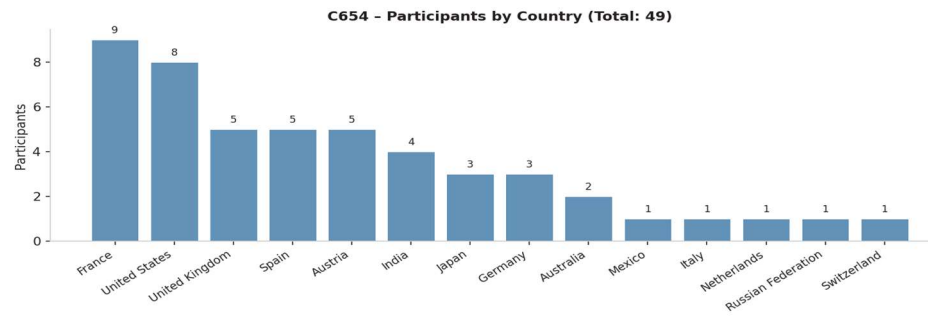
Open discussions on benchmark datasets and solver validation highlighted the community's need for standardised test cases in FSI, particularly for highly flexible structures and multi-body systems at intermediate Reynolds numbers.

Organization

The colloquium was held over three days in Vienna, Austria. Registration fees were 500 EUR (early bird) and 550 EUR (regular). No additional external funding was obtained. The registration fee covered coffee breaks, lunches, conference dinner, and a guided visit to the Secession Museum. Total participants: 49 (from 14 countries).

Conclusion

EUROMECH Colloquium 654 successfully brought together an internationally diverse community to advance bio-inspired fluid-structure interaction research. The combination of formal presentations and open discussions led to productive exchanges and identified several collaborative opportunities. The organisers thank EUROMECH for its support.



EUROMECH Colloquium 655

Cutting mechanics of soft tissues: Nonlinear fracture and contact mechanics

25–27 August 2025, Graz, Austria

Chairperson: Prof. Gerhard A. Holzapfel

Co-chairpersons: Prof. John Kolinski, Prof. Benny Bar-On

Introduction

The mechanical behaviour of soft biological tissues during cutting, fracture, and contact is of fundamental importance in surgery, medical device design, and the understanding of injury mechanisms. EUROMECH Colloquium 655 on "Cutting mechanics of soft tissues: Nonlinear fracture and contact mechanics" was held in Graz, Austria, from 25 to 27 August 2025, bringing together 42 specialists from 16 countries.

The meeting focused on the intersection of continuum mechanics, fracture mechanics, and experimental biomechanics, with strong connections to clinical applications and computational modelling.

Scientific Program Highlights

The programme covered a broad spectrum of topics including: nonlinear fracture mechanics of soft gels and biological tissues; cutting and needle insertion mechanics; contact and adhesion of compliant biological interfaces; experimental characterisation of tissue failure; and computational methods for crack propagation in soft materials.

Contributions from the most active groups in the field presented novel experimental methods including digital image correlation on hydrogels, cutting force measurements during surgery simulations, and high-speed imaging of crack initiation in biological materials. Theoretical contributions advanced the understanding of Griffith-type fracture criteria for highly

deformable materials, the role of viscoelasticity in energy dissipation during cutting, and hyperelastic models for soft tissue failure.

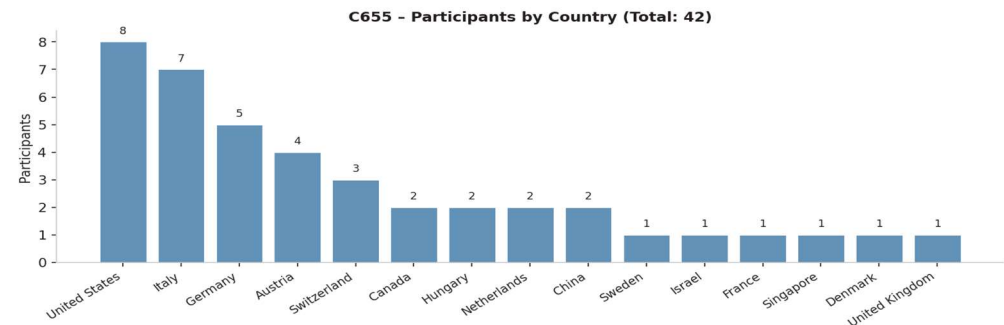
A dedicated session on needle-tissue interaction attracted strong interest, with presentations on penetration mechanics, haptic feedback for robotic surgery, and the influence of needle geometry and tip shape on cutting force and tissue damage.

Organization

The colloquium was held at Graz, Austria. Registration fees were 360 EUR (speaker, early bird), 450 EUR (speaker, standard), 260 EUR (student/poster, early bird), and 300 EUR (student/poster, standard). Total participants: 42 (from 16 countries).

Conclusion

EUROMECH Colloquium 655 provided an important focal point for the community working on the mechanics of soft tissue cutting and fracture. The quality and breadth of contributions confirmed the vitality of this emerging field. The organisers thank EUROMECH for its support in making the event possible.



EUROMECH Colloquium 657

Recent advances in non-smooth dynamics

8–10 December 2025, Exeter, UK

Chairperson: Prof. Yang Liu

Co-Chairpersons: Dr Aasifa Rounak, Prof. Petri Piiroinen, Prof. Piotr Kowalczyk

Introduction

Non-smooth dynamical systems arise naturally in a wide range of physical, engineering, biological, and socio-technical systems, where discontinuities, impacts, friction, switching, saturation, and threshold effects play a fundamental role. Such phenomena are ubiquitous in applications including mechanical systems with impacts or frictional contacts, power electronics, control and hybrid systems, structural dynamics, robotics, biomechanics, and neuroscience. EUROMECH Colloquium 657 brought together leading researchers and early-career scientists working on theoretical, numerical, experimental, and data-driven aspects of non-smooth dynamics.

Scientific Program Highlights

The colloquium was held over 2.5 days at the University of Exeter, hosted by the Exeter Small-Scale Robotics Laboratory. The programme included 9 keynote lectures and 42 invited and contributed talks, complemented by structured discussion sessions and informal scientific exchanges. In total, the meeting featured more than 51 presentations from internationally recognised experts and early-career researchers from 13 countries.

A particular emphasis was placed on discontinuity-induced bifurcations, Filippov systems, piecewise-smooth maps and flows, vibro-impact systems, non-smooth control, and emerging links with machine learning, robotics, and biomechanics. The diversity of contributions — spanning from rigorous

mathematical theory to applied engineering problems — exemplified the interdisciplinary nature of non-smooth dynamics.

A defining feature of the colloquium was a dedicated early-career session, providing PhD students and postdoctoral researchers with a platform to present their work alongside established leaders in the field. This session generated enthusiastic engagement and positive feedback from all participants.

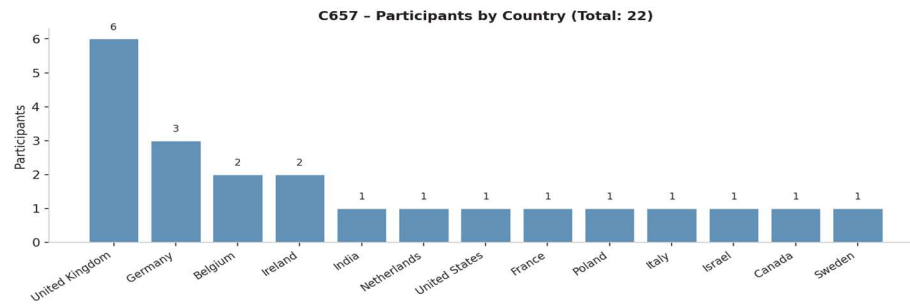
Cross-cutting discussions highlighted the growing importance of data-driven and machine-learning-based methods for the identification and control of non-smooth systems, as well as the need for rigorous mathematical frameworks that can handle the increasing complexity of modern engineering applications.

Organization

The colloquium was held from 8 to 10 December 2025 at the University of Exeter. Registration fee: 300 EUR (regular). No additional external funding was obtained. Participants were offered 8 coffee breaks, two lunches, and one gala dinner. Total participants: 22 (from 13 countries).

Conclusion

EUROMECH Colloquium 657 successfully consolidated an active international community and identified several key directions for future research in non-smooth dynamics. The organisers thank EUROMECH for financial support and the University of Exeter for hosting.



EUROMECH Colloquium 658

Coherent structures and instabilities in transitional and turbulent wall-bounded flows

15–17 September 2025, Bari, Italy

Chairperson: Dr Stefania Cherubini

Co-Chairperson: Prof. Jean-Christophe Robinet

Introduction

It is still considered a remarkable fact that three-dimensional coherent motion develops in fluid flows at Reynolds numbers much smaller than the critical value for the rise of two-dimensional instabilities. This behaviour is recovered in simple parallel flows, such as pipes, boundary layers and channels, which are prone to subcritical transition, as well as in wall-bounded flows around solid objects of complex geometry. For fully turbulent flows, three-dimensional coherent structures such as streaks and hairpin vortices are repeatedly observed and their origin and organisation remain a subject of intensive research.

EUROMECH Colloquium 658 was designed to bring together researchers studying the rise and development of instability mechanisms leading to three-dimensional flow structures in different shear flows, aiming to cross-fertilise the communities working on subcritical transition, instability of

turbulent flows, and coherent structures. The event was held at Politecnico di Bari, Italy, from 15 to 17 September 2025.

Scientific Program Highlights

The colloquium was organised into six main sessions. "Subcritical transition in canonical shear flows" gathered presentations on the fundamental mechanisms of transition in pipes, channels, and Couette flow, including contributions on exact coherent structures, the role of non-normality and transient growth, and the self-sustained cycle of near-wall turbulence.

"Transition control" presented methods for delaying or promoting transition through wall actuation, plasma actuators, and optimised surface modifications. The "Resolvent and receptivity analysis" session brought together work on the global resolvent approach, a currently very popular methodology that shows remarkable efficiency for both transitional and turbulent flows.

"Compressible flows" highlighted the renewed interest in high-speed (super/hypersonic) flows, where methods initially developed for incompressible flows are being transposed, accounting for shock-wave discontinuities and acoustic radiation. Sessions on "Coherent structures in turbulent flow" and "Coherent structures and instabilities in complex flow" illustrated the growing interest in the dynamical — rather than purely statistical — analysis of turbulent structures.

Organization

The colloquium was held from 15 to 17 September 2025 at Politecnico di Bari. Funding of 1,000 EUR was received from Politecnico di Bari. Participants were offered morning coffee breaks, lunches, a welcome cocktail with a guided tour of the Old Town, and a social dinner with a bus trip to Alberobello. Total participants: 50 (36 EUROMECH members + 11 existing members + 3 invited).

Conclusion

The success of this conference encourages us to continue with the aim of bringing together the instability of turbulent flows, subcritical transition, and coherent structures research communities. We thank EUROMECH for making this meeting possible, and for all the financial and organisational support.

EUROMECH Colloquium 659

Metamaterials in fluid flows and beyond

25–28 March 2025, Groningen, The Netherlands

Chairperson: *Dr Anastasiia O. Krushynska*

Co-Chairpersons: *Dr Francesco Avallone, Dr Marios Kotsonis, Dr Muamer Kadic*

Introduction

Mechanical and acoustic metamaterials have emerged as a powerful paradigm for engineering the propagation of waves and flows through structured media with engineered microarchitecture. EUROMECH Colloquium 659 on "Metamaterials in fluid flows and beyond" brought together leading researchers working on acoustic, elastic, and flow-control metamaterials to consolidate recent advances and identify future directions. The colloquium was held from 25 to 28 March 2025 in Groningen, The Netherlands, and attracted 94 participants from 14 countries.

Scientific Program Highlights

The scientific programme was organised around several key themes: aeroacoustic metamaterials for noise reduction; flow-control metamaterials and surface texturing; phononic crystals and locally resonant structures; nonlinear and topological metamaterials; and multiphysics and multi-functional designs.

A strong focus was on aeroacoustic applications: contributions addressed the design of serrated trailing edges, bio-inspired riblets, porous coatings, and resonator arrays for airframe and rotor noise reduction. Results demonstrated significant broadband noise attenuation achievable with tailored surface microstructures, stimulating discussion on bridging laboratory demonstrations and industrial deployment.

In elastic wave control, presentations on locally resonant metamaterials, pentamode materials, and topological insulators demonstrated the versatility of structured media for vibration mitigation and wave focusing. Emerging topics included active and programmable metamaterials that respond to external stimuli, non-reciprocal wave propagation, and the use of machine learning for inverse design of metamaterial microstructures.

The interdisciplinary breadth of the colloquium was a highlight: talks ranged from mathematical foundations — homogenisation theory, band-gap calculations — to experimental demonstrations and computational design workflows. A poster session on the first evening allowed early-career researchers to present their work in an informal setting.

Organization

The colloquium was organised at the University of Groningen with financial support from the Engineering and Technology Institute Groningen (Faculty of Science and Engineering) and the MetaFlow project (KICH1.ST04.22.010), funded by the Dutch Research Council (NWO). Registration fees were 550 EUR (regular), 400 EUR (reduced), and 300 EUR (PhD students). The registration fee included the book of abstracts, colloquium dinner, daily coffee breaks and three lunches, and a welcome reception on 25 March 2025. Total participants: 94 (from 14 countries).

Conclusion

EUROMECH Colloquium 659 provided an excellent opportunity to consolidate a vibrant interdisciplinary community and to chart future directions for metamaterial research with applications in fluid flows and beyond. The organisers thank EUROMECH, the Engineering and Technology Institute Groningen, and NWO for their generous support.

