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Introduction to the Acta IMEKO Thematic Issue 'IMEKO TC15 Collegium 2026' – Part 2

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Dear Readers,

This second part of the Acta IMEKO Thematic Section dedicated to the IMEKO TC15 Collegium 2026 completes the collection of contributions originating from the meeting held in Prague, Czech Republic, from 10 to 12 June 2026. Together with the six papers published in the previous issue, the five contributions presented here reflect the diversity of research topics addressed within IMEKO Technical Committee 15 – Experimental Mechanics.

While the first part highlighted developments in advanced imaging, experimental techniques and computational methods, the present collection focuses particularly on the mechanical characterization and modelling of materials and structures under different loading conditions. The contributions cover additively manufactured lattice structures and reinforced composites, masonry joints and concrete, as well as stress-wave propagation in multimaterial metallic specimens. Despite their different applications, these studies share an emphasis on understanding mechanical response through carefully designed experiments, advanced measurement techniques and, where appropriate, numerical modelling.

Topić Brečević et al. [1] investigate the quasi-static compressive response of an additively manufactured tetrachiral lattice using finite element modelling and experimental measurements. The constitutive behaviour of the photopolymer base material is characterized through compression tests on bulk specimens and subsequently incorporated into a three-dimensional numerical model based on the nominal lattice geometry. The model reproduces the initial experimental force–displacement response reasonably well but progressively overestimates the load-carrying capacity at larger deformations. To investigate possible sources of these discrepancies, the authors compare the nominal geometry with the actual structure reconstructed from X-ray computed tomography data. The observed manufacturing-induced deviations, particularly in the struts and their junctions, highlight the limitations of idealized geometries and motivate the development of image-based numerical models incorporating as-manufactured structures and experimentally determined boundary conditions.

Zaplatić et al. [2] examine the compressive behaviour and damage evolution of additively manufactured polyamide composites reinforced with continuous carbon fibres. The specimens are subjected to monotonic and cyclic compression, while digital image correlation provides full-field measurements of the developing deformation. X-ray computed tomography is additionally employed to characterize manufacturing-induced porosity before mechanical testing. The experiments reveal progressive strain localization, fibre kinking, splitting and delamination, together with irreversible deformation and stiffness degradation during cyclic loading. By combining global mechanical measurements with local strain fields and correlation residuals, the study demonstrates the value of optical full-field techniques for identifying damage initiation and monitoring its subsequent development in additively manufactured composite materials.

Kovaček et al. [3] investigate the tensile and shear performance of polyurethane foam adhesive joints used in masonry construction, with particular attention to the influence of environmental exposure. Specimens maintained under controlled laboratory conditions are compared with those subjected to natural outdoor conditions over a period of 33 days. Quasi-static mechanical testing is complemented by digital image correlation during shear loading, enabling local joint deformation to be distinguished from the global displacement recorded by the testing machine. The exposed specimens exhibit reduced load-bearing capacity in both tensile and shear tests, indicating the sensitivity of polyurethane adhesive joints to environmental conditions. Although the relatively short exposure period and limited number of specimens restrict broader conclusions

regarding long-term durability, the results provide useful preliminary evidence for assessing the mechanical performance of these alternative masonry bonding systems.

Kozáková et al. [4] address the determination of concrete fracture energy under monotonic and cyclic loading, an important issue for the identification of parameters used in cohesive fracture models. The authors compare conventional static three-point bending tests with low-cycle loading experiments performed on notched concrete beams of identical geometry and material composition. Fracture energy is evaluated using the load–crack mouth opening displacement response, with the envelope of the cyclic loading curves employed to characterize the corresponding fracture behaviour. The cyclic experiments yield lower fracture energy values than the static reference, while unloading stiffness measurements reveal progressive damage accumulation. The study demonstrates the potential of cyclic loading envelopes for identifying fracture parameters, while also discussing limitations associated with hysteretic energy dissipation and the interpretation of results obtained from a limited experimental dataset.

Zlámal et al. [5] investigate the propagation of short stress waves across material interfaces in metallic multimaterial specimens manufactured by laser powder bed fusion. Cylindrical specimens combining CuCr1Zr copper alloy and 13Ni400 maraging steel are tested using a Forward Direct Impact Hopkinson Bar, with strain gauges positioned immediately before and after the material interface. Measurements are performed for both propagation directions and compared with corresponding single-material reference specimens. Analysis of the recorded signals in the time and frequency domains reveals modifications of the stress pulse associated with the interface, including direction-dependent differences in waveform shape and spectral content. The authors also demonstrate that dispersion and propagation effects within the finite cylindrical specimens contribute substantially to the measured response, emphasizing the need to distinguish these effects from the interaction of stress waves with the material interface.

Together, the eleven contributions published across both parts of this Thematic Issue illustrate the breadth of contemporary experimental mechanics and the importance of combining reliable measurements with appropriate interpretation and modelling. They also demonstrate how advances in imaging, full-field measurement techniques and computational approaches contribute to a better understanding of material behaviour, structural response and damage mechanisms across different length scales and loading conditions.

We would like to thank all contributing authors and reviewers for their efforts, as well as the colleagues involved in organizing the IMEKO TC15 Collegium 2026 and preparing this Thematic Issue. We are particularly grateful to the editorial and production teams of Acta IMEKO for their support throughout the publication process.

We hope you will enjoy your reading.

Daniel Kytýř, Emina Hadžalić and Zvonimir Tomičević
Section Editors

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