

Editorial

The growing complexity of modern engineering structures, alongside the application of advanced materials and innovative manufacturing technologies, has created a strong demand for more sophisticated approaches to structural integrity assessment, structural analysis, fracture and fatigue of structures. These topics also highlight the need of advanced, non-standard and state-of-the-art methodologies.

To start with, this Special Issue covers recent advancements in Machine Learning (ML) and Artificial Intelligence (AI) applied to structural engineering problems. This includes, for example, inverse methods for determining elastic coefficients of unsymmetric laminates, comparative evaluations of neural network and analytical approaches in modelling fatigue fracture of titanium alloys, and ML-based prediction of Wöhler curves for steels such as CK35. Advanced AI models, including optimised stacking ensemble techniques for predicting the hysteresis behaviour of shape memory alloys, as well as the review of application of artificial intelligence in metallography, ensure that all major AI-driven methodologies are represented.

The Issue further incorporates comprehensive research related to complex structural systems and advanced engineering applications. Topics such as the utilisation of sandwich composites in floating oscillating water column structures under impulse loading, finite element assessment of ship structures under static and dynamic loads, and dynamic stability analysis of trimaran-type floating systems with large appendages are fully included. Additionally, studies focusing on structural optimisation and performance enhancement, such as surface texturing for anti-vibration support structures in heat exchanger tubes, are also presented.

Significant emphasis is placed on durability, damage mechanics, and failure analysis, covering all relevant aspects from fundamental research to practical applications. This includes computational estimation of roller bearing service life, phase-field damage modelling of high-strength steel with experimental validation, and detailed investigations of mechanical and fracture behaviour of advanced materials such as PROTAC 500 armour steel. Everyday engineering practice is also addressed through topics such as repair procedures for boiler flue pipes, ensuring that applied and industrial perspectives are equally represented.

Furthermore, the Special Issue fully addresses structural integrity under complex and extreme conditions. This includes simplified SPSI analysis of cement silos exposed to liquefaction, combined methodologies for integrity assessment of welded joints with multiple defects, including an UHSLA steel, and non-destructive evaluation techniques such as electrical conductivity measurements for assessing the quality of friction stir welded aluminium lap joints. Thermal and long-term effects are also covered, including temperature-induced fracture of inhomogeneous bars with constrained supports and the investigation of thermal ageing effects on materials used in critical systems such as WWER-1000 reactors over extended operational periods.

Overall, the papers in this Special Issue include all the aforementioned topics, providing a unified and comprehensive overview of current research and emerging trends in the field.

Belgrade, October 2026

Editors

Ana Petrović
Mihajlo Arandelović
Stefan Dikić

Ana Petrović

Ana was born in 1988 in Belgrade, Serbia, graduated from the 4th Belgrade Gymnasium School in 2006. She has finished B.Sc. studies in 2009 at the Faculty of Mechanical Engineering, University of Belgrade, with average scores 10/10 and M.Sc. studies in 2011, with average scores 10/10 (the best student in generation). She has finished Ph.D. studies in 2017, at the same faculty. Ana Petrovic is an Associate Professor at the Department of Strength of Structures, Faculty of Mechanical Engineering, University of Belgrade, engaged in teaching and research work in the field of *Strength of Materials*.

She has participated in more than 30 international conferences and published several academic papers, among them more than 20 papers in categories Q1-Q3, dealing with *Applied mechanics*, *Strength of complex steel structures* (primarily mining machinery), *Structural dynamic reanalysis*, *Probability of failure* and *Risk assessment*, and *Model testing of complex structures*, as well as *Stereometric measuring using Digital Image Correlation*. She has academic experience in use of various data software packages for FEM analysis. She has also taken part in numerous experiments dealing with structural strength. (SCOPUS 33 documents, 184 citations, h = 9).

Ana is the Head of the Laboratory for Stress and Strain Analysis at the Faculty of Mechanical Engineering, Department of Strength of Structures. She is a member of the Serbian Society of Mechanics, the Society for Structural Integrity and Life 'Prof. Stojan Sedmak' and the European Structural Integrity Society (ESIS), and has been participating, as a researcher, in several national, and several bilateral projects (Serbian-Chinese, Serbian-Hungarian), and a International COST Action.

She is also the author of two comprehensive workbooks used as part of teaching material for Strength of Materials courses.

Mihajlo Arandelović

Born in 1985, in Belgrade, Republic of Serbia. He has completed primary and high school in Paraćin with honours. Following his Master's studies, he completed his PhD studies in 2022 at the Faculty of Mechanical Engineering, University of Belgrade. Currently, he holds the position of Research Associate at the Innovation Centre of the Faculty of Mechanical Engineering in Belgrade. He serves as the Quality Control Manager of the Centre for Control and Certification (Notified Body), and is a PED Inspector (Pressure Equipment Directive) and Welding Inspector. Furthermore, he served as a Research Associate at the Faculty of Civil Engineering, Transilvania University of Braşov, from 2023 to 2024. He actively participates as a researcher in several international projects.

He has published over 50 scientific papers, a significant number of which are indexed in the Q1-Q3 categories, focusing on *Materials science*, *Welding*, and *Fracture mechanics*. (Scopus: 30 documents, 217 citations, h = 9).

He is a member of the Serbian Welding Society (DUZS), the Society for Structural Integrity and Life (DIVK) 'Prof. Stojan Sedmak,' and the European Structural Integrity Society (ESIS).

Stefan Dikić

Stefan was born in 1992 in Belgrade, Serbia, graduated from the 13th Belgrade Gymnasium School in 2011. He has finished B.Sc. studies in 2015 at Faculty of Technology and Metallurgy, University of Belgrade, M.Sc. studies in 2016, and PhD studies in 2023, at the same faculty. He is an Assistant Professor at the Department of Metallurgical Engineering, Faculty of Technology and Metallurgy, University of Belgrade, engaged in teaching and research work in the fields of *Physical metallurgy*, *Welding* and *Materials testing*.

He has participated in more than 20 international conferences and published several academic papers, among them more than 15 papers in categories Q1-Q3, dealing with microalloyed steels, phase transformations, welding, hot rolling, and materials testing. He has also taken part in numerous experiments dealing with structural strength. (SCOPUS 19 documents, 109 citations, h = 5).

He is a member of Serbian Society of Mechanics, Society for Structural Integrity and Life – 'Prof. Stojan Sedmak,' the European Structural Integrity Society (ESIS), the China-Serbia Belt and Road Joint Laboratory on Green Steel Manufacturing, and the Serbian Welding Society. He has participated, as a researcher, in several national, several international projects, as well as projects in collaboration with industry.

In addition, he also holds IWE and IWI-C certifications, as well as a certificate for the visual inspection of welded joints, castings, and forgings. He is also a lecturer in courses for International Welding Engineers and International Welding Technologists.