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Editorial

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Whenever I am asked to write the editorial for *Structures and Buildings* I see it as an opportunity to subtly remind our readership of the need for the industry to re-assess its attitude to technology and innovation; using the papers to encourage deeper thinking about how the benefits of both academic research and practical case studies can be leveraged to add value to our everyday projects.

This month the task is easier than usual as the journal presents a themed issue, collating papers that have a particular focus on innovative technologies and advances in structural engineering. The result is a diverse range of papers, from the analysis of the meso-behaviour of concrete to the development of an innovative flexible connection for an immersed tunnel mega-project. The topics covered include optimisation algorithms, smart materials, parametric design and innovative connections. It is encouraging to observe not just a wide range of technical topics, but also the depth and quality of research and practical studies.

The first paper by Dehcheshmeh *et al.*, (2022) explains the use of a moth-flame optimisation (MFO) algorithm to detect damage in structures as a potential method for structural health monitoring (SHM). The paper includes numerical studies of various structures including a plane steel truss, plane steel frame and an 8-storey shear frame each including hypothetical damage to structural elements. Introducing signal noise to simulate real-life conditions, the algorithm was able to use differences in modal frequencies to detect structural elements that showed damage. The MFO algorithm was found to be computationally efficient and more reliable than other optimisation algorithms and was recommended as a method to identify damage in real SHM scenarios.

The second paper by Sharghi *et al.*, (2022) explored the use of Prandtl neural networks (PNN) to simulate non-linear substructures to develop a neuro-hybrid analytical approach for non-linear frames. The paper describes studies on a one-storey frame and a four-storey moment-resisting frame with dampers. The paper concludes that the use of PNNs demonstrated the feasibility of the system and showed a reduction in computation times.

The next paper by Zhan *et al.*, (2022) explores the performance of a shape memory alloy (SMA)/piezoelectric ceramic compound damper. The paper describes the physical tests on SMA wires to establish hysteretic performance, data which is then used to inform a back-propagation neural network model of the damper. A Takagi-Sugeno fuzzy controller is applied to modulate the friction of the damper under load. Results of simulations showed the proposed damper was effective in restraining the dynamic response of the structure, with hybrid control reducing seismic vibrations better than passive control.

Sridhar and Prasad (2022) describe a study to evaluate the damage of functionally graded reinforced concrete beams with hybrid fibre-engineered cementitious composite (HYFECC) layers under static and dynamic testing. The studies explore different numbers of layers of HYFECC in the tensile zone. Results indicated an increase in load-carrying capacity of up to 35.9% compared with the control reinforced concrete beam, and also registered a reduction in the modal frequencies.

The paper by Chahade *et al.*, (2022) presents a digital design process utilising parametric modelling of timber hyperbolic gridshells to explore design options and design efficiencies through integrated Finite Element modelling. The paper also introduces the use of 3D shaped grouted joints for the circular-section timber members.

Staying with the topic of novel joints, the paper by McGetrick PJ *et al.*, (2022) discusses the experimental testing and numerical analysis of intermeshed steel connections (ISC), a concept which looks to benefit from precision cutting and manufacturing methods to design connections that minimise bolting and field welding. The study explores both front and side assembled ISCs considering issues such as structural performance, assembly and the impact of manufacturing and assembly tolerances and highlights key issues for further research in the development of ISCs.

Lim *et al.*, (2022) take a close look at meso-scale Finite Element modelling of concrete to explore both strength and size effects. The study includes explicit representation of aggregate, cement matrix and interfacial transition zones, and includes a range of tests such as axial compressive, flexural compressive, splitting tensile, direct tensile and shear strength tests. The results confirmed the validity of the numerical models for the various failure mechanisms and crack development. The paper concludes that further studies are required to explore the impact of various parameters.

Finally, the paper by Lin *et al*., (2022) looks at the development of a novel semi-rigid system of connecting segments of a 5.7 km immersed tunnel section. The system uses a shear key, enhanced with friction generated through compressive force across the segment joint. Pre-stressing helps to provide the compressive force and, in conjunction with a flexible gasket, provides flexibility for movement and water-resistance. The paper concludes that the system has performed well in service and should be considered more widely for immersed tunnels.

I sincerely hope you enjoyed this themed issue of *Structures and Buildings* and that the papers have been thought-provoking.

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