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Editorial

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Editorial

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If you've been paying attention you may have noticed that our industry is engaged in a (perhaps long-overdue) digital transformation. Whilst this is to be lauded and wholeheartedly supported, there is a temptation for the profession to be distracted by the necessary development of digital skills, the increasing application of software, data analytics opportunities and the potential rise of nanotechnology. With a dizzying uptake of technology in the profession, there is a genuine concern amongst some that engineering will become commoditised and that increasingly connected vertical supply-chains will require less and less unique, solution-driven engineering.

However, as demonstrated by this month's issue of *Structures and Buildings*, it is apparent that the real world is not collapsible into a set of predictive algorithms and our surrounding infrastructure is inherently complicated and full of uncertainty.

An example of this is the fundamentally complex behaviour of masonry under cyclic or transient loads. The assessment and strengthening of non-engineered masonry structures is therefore an area requiring significant skill and engineering judgement. In this month's issue we have three papers that explore such behaviour and demonstrate the artful application of science to further engineering understanding of non-engineered structures.

The in-plane behaviour of ashlar stone masonry walls subjected to seismic loads is studied in Liu *et al.* (2019). The paper examines the influence of enhanced mortar joints including high-strength polymer mortar and embedded steel reinforcement. The paper describes a series of full-scale tests carried out on ashlar masonry wall specimens under cyclic horizontal loads and concludes that mortar-bed strengthening is an effective, aesthetically sympathetic and practical means of improving the load carrying capacity.

The paper by Mai *et al.* (2019) studies the dynamic structural response of historic masonry arch bridges in Korea and concludes that the behaviour is fundamentally complex and dependent on numerous parameters related to geometry, constituent materials, deterioration and the form of original

construction; making analytical prediction of behaviour subject to variation and difficulty.

Continuing the theme of non-engineered structures, the paper by Kazmi and Sodangi (2019) contains a useful insight into the factors influencing the performance of non-engineered structures subjected to seismic events. The paper explains the process of gathering data from construction professionals following the Kashmir Earthquake in 2005 and conducts a severity analysis of the findings with a view to establishing which factors contribute most to mass-scale devastation. The paper concludes that factors relating to location contribute the most, above other more intuitive factors such as the type of structural system.

Of course, regardless of the applied technology, engineering progress will always be dependent on the application of the scientific method to further our understanding of the fundamental principles, develop appropriate numerical models and form associated standards and guidelines. The next three papers provide an example of how engineering progress is made on this basis.

The paper by Ellobody *et al.* (2019) is a typical example of an experimental test to understand the resultant performance of a particular combination of factors not previously investigated; in this instance the use of stainless steel tubular columns filled with steel-fibre-reinforced concrete. The paper explains a thorough methodical approach to testing, incorporating a range of parameters including depth-to-plate ratios, cross-sections, lengths, slenderness concrete strengths and steel fibre content, and compares the results with existing design equations. The paper concludes that the addition of steel fibres significantly enhances the strength of stainless steel tubular columns and an increase in steel fibre content correlates with greater column strength. The paper also concludes that the Eurocode 4 design equations are not necessarily accurate or conservative in all cases considered.

The study of a damped hybrid outrigger system by Wang (2019) provides an excellent example of design development

validated by extensive research comprising robust physical and numerical testing. The paper details the basis of a novel outrigger design for high-rise buildings that utilises composite behaviour and incorporates the use of a low-yield damper. Large scale models of the system were tested under both monotonic and cyclic loads and the performance verified against detailed non-linear finite element modelling. The paper summarises the performance of the outrigger system, proposes further study to explore a range of associated design parameters and to develop appropriate design rules.

The final paper in this month's issue by Isleem *et al.* (2019) is an extremely thorough review of previous research undertaken on fibre-reinforced polymer-confined rectangular concrete columns and presents a critical and statistical study of relevant research to arrive at a proposed numerical model determined through the use of multi-parameter regression. The model incorporates the effects of aspect ratio, cross-section size, polymer rupture strain and the internal hoop steel reinforcement, and is demonstrated to have good correlation with the sampled test data.

On this note, it is interesting to consider how new technology may change or augment our approach to engineering research. Rather than provide an all-encompassing threat to the engineering profession it is exciting to consider how the use of technological tools such as artificial intelligence may unlock a greater understanding of engineering behaviour and provide the means to develop correlations and predict behaviours that would otherwise be impossible.

I sincerely hope you enjoy this issue of *Structures and Buildings*, and if the subject of technology and engineering is of interest, I would encourage you to consider submitting papers for the upcoming Themed Issue 'Technological Advancements in Structural Design'.

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