Spotlight on Structures

Research Journal of The Institution of Structural Engineers

In this section we shine a spotlight on papers recently published in *Structures* – the Research Journal of The Institution of Structural Engineers.

***Structures* is a collaboration between the Institution and Elsevier, publishing internationally-leading research across the full breadth of structural engineering which will benefit from wide readership by academics and practitioners.**

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Structures prizes announced

This month we are delighted to announce the winners of the 2019 *Structures* prizes. Congratulations to the following joint winners of the 'Best Research Paper Prize':

- Dan Bompa and Ahmed Elghazouli for their paper 'Monotonic and cyclic performance of threaded reinforcement splices' published in Volume 16, November 2018.
- Christian Málaga-Chuquitaype and Jeremy Ilkanaev for their paper 'Novel Digitally-manufactured Wooden Beams for Vibration Reduction' published in Volume 16, November 2018.

We also congratulate Anders Klasson, Ivar Björnsson, Roberto Crocetti and Eva Frühwald Hansson on winning the 'Best Research into Practice Paper Prize' for their paper on 'Slender Roof Structures – Failure Reviews and a Qualitative Survey of Experienced Structural Engineers' published in Volume 15, August 2018.

All three papers will be free to read until 30 September 2019.

The annual *Structures* prizes are judged by The Institution of Structural Engineers Research Panel and supported by Elsevier. Each prize carries an award of £500.

Best Research Paper (joint winner)

Monotonic and cyclic performance of threaded reinforcement splices

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This paper examines the fundamental uniaxial monotonic and cyclic response of reinforcement bars connected with threaded mechanical couplers. Based on a survey of available splicing forms, two types of threaded couplers with different geometric configurations, namely 'parallel threaded couplers' and 'parallel threaded sleeve couplers' are selected for detailed assessment. An experimental study consisting of twenty-four bare (in-air) and embedded (in-concrete) specimens incorporating threaded couplers and non-spliced counterparts, is described. The results enable direct assessment of strength as well as complete deformation characteristics, including the post-cracking and post-yield response, for both monotonic and cyclic conditions. After describing the material properties and specimen details, the main observations are reported based on detailed measurements of crack kinematics including crack width and spacing through a digital image correlation system. Complementary numerical studies, undertaken using nonlinear finite element procedures which are validated against the tests, enabled supplementary parametric investigations accounting for wider ranges of coupler geometries. The findings show that existing guidelines may be used for assessing the crack width and spacing, by accounting for the characteristic bond behaviour at the rebar and coupler regions. The complete deformational response may be obtained by using a suggested stiffness reduction factor that depends on the coupler geometry. Several 'in-air' performance parameters may also be used as a basis for the selection and implementation of couplers in applications requiring ductile member behaviour.

The full paper is available at https://doi.org/10.1016/j.istruc.2018.11.009.

Best Research Paper (joint winner)

Novel Digitally-manufactured Wooden Beams for Vibration Reduction

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The low modal mass and stiffness of timber floors impose a number of motion-control challenges to the structural designer. These difficulties can often led to the implementation of sub-optimal solutions, such as the addition of supplemental mass and stiffness in the form of concrete slabs, that conflict with the claimed sustainability and lightweight advantages of wood. In this paper, we present a novel beam configuration that enhances the vibration comfort response of timber flooring systems while retaining the original environmental benefits of wood in construction. By taking advantage of modern digital-fabrication tools, we devise, test and analyse new beam configurations that incorporate flexural resonators tuned to key structural frequencies of the system. These resonators are integrated into the body of the beam and the structure is sized to satisfy typical strength and stiffness demands. A series of numerical, experimental and parametric studies demonstrate the vibration absorbing capabilities of the new designs and the feasibility of their implementation to satisfy current occupant comfort criteria.

The full paper is available at https://doi.org/10.1016/j.istruc.2018.08.003.

Best Research into Practice Paper

Slender Roof Structures – Failure Reviews and a Qualitative Survey of Experienced Structural Engineers

Anders Klasson[a], Ivar Björnsson[a], Roberto Crocetti[b] and Eva Frühwald Hansson[a]
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Many slender roof structures have collapsed due to snow loading and instability. Although accurate stability calculations can be performed using theoretical models, these calculations may not always reflect the behaviour of real structures as a result of the uncertainties relating to e.g. loading, material behaviour, geometry, initial imperfections and the actual boundary conditions of the structure. As a result, the approach to stability design requires subjective decisions by the structural engineer concerning loading and modelling assumptions. This paper investigates the significance of these types of decisions made by structural engineers in designing slender roof structures. This investigation is based on a review of previous failure studies together with a survey of 17 experienced structural engineers. The results of this investigation indicate that most structural failures are a result of human errors; thus, a suitable strategy for avoiding errors is through quality control and design checking. Moreover, a significant discrepancy was observed concerning design assumptions made by the engineers in the study. Some of these assumptions, e.g. a non-conservative choice of the buckling length of a beam, have a significant negative impact to structural safety. It is therefore recommended that the structural engineers involved in the design of a structure have adequate experience and a holistic mindset. Another recommendation is that both drawings and design calculations are thoroughly reviewed before construction. Also, temporary bracing to be used during construction should be included in design. Finally, it is important that the communication between different partners in the design of a structure is satisfying.

The full paper is available at https://doi.org/10.1016/j.istruc.2018.06.009.