Title: Development of high-performance structural systems for seismic applications

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Abstract: Recent earthquakes in Japan and New Zealand have shown that even the most developed countries with modern building codes still vulnerable to strong earthquake shaking. The issue lies in the fundamental approach in the structural design, where the earthquake energy is absorbed through inelastically deformation of the structural components. This design approach leads to unrecoverable structural damages and hefty social and financial losses. The loss due to earthquake can be minimized using high-performance earthquake resilient structures, where designated structural fuses, analogous to electrical fuses, are used to dissipate the sudden surge of earthquake energy. This design philosophy will achieve higher performance and allowing the structure to recover efficiently and economically after strong earthquake shaking. Innovative earthquake resilient structures has been developed in the past. However, there is a lack of practical design procedure that can be used by engineering design committee. In this presentation, a novel design procedure, named equivalent energy-based design procedure (EEDP) for fused structures in earthquake applications will be presented. EEDP allows engineers to select structure performance objectives when the structure is experiencing different levels of seismic shaking intensities. With the use of the developed methodology, engineers can efficiently select the structural member sizes to achieve the desire structural period, strength and deformation with simple hand calculation without iteration. Hence, it is very practical and useful for the seismic engineering design communities. Two innovative earthquake resilient structures named Linked Column Frame (LCF) and fused truss moment frames (FTMF) are designed using EEDP and presented. Nonlinear dynamic analyses were conducted to examine the performance of these two innovative fused structural systems. The result shows the proposed EEDP methodology is able to achieve the performance defined by the engineer, making this design procedure ideal for practicing engineering community where high-performance structural systems can be developed for seismic applications.

Bio: Professor Tony T.Y. Yang is a fellow of Canadian Academy of Engineering, Director of Smart Structures Laboratory and Head of Structural Engineering division at the Department of Civil Engineering at The University of British Columbia. He is a world-renowned for his ground-breaking innovation in performance-based design, structural simulation and testing, robotic inspection and construction and high-performance, carbon-neutral and resilient infrastructure. Prof. Yang is one of the 19 voting members of the Standing Committee for Earthquake Design, which is responsible for writing the seismic design provision of the 2020/2025 National Building Code of Canada (NBCC). Prof. Yang is also a committee member of S16, which is responsible for writing the design provision of steel structures in the Canada. Prof. Yang's work has been well recognized by his colleagues, he is the recipient of the 2020 Meritorious achievement award from Engineers & Geoscientists British Columbia Canada, which is the highest achievement award given to a professional engineer (P. Eng.) in British Columbia, Canada, 2019 Technology award from the New Zealand Concrete Society and the 2014 CISC H.A. Krentz award for the highest impacted steel research from the Canadian Institute of Steel Construction.