01 Oct 2018

Sensor-Enhanced Analysis and Behavior of Steel Beams in Fire

Genda Chen

Missouri University of Science and Technology, gchen@mst.edu

Genda Chen, J Civil Environ Eng 2018, Volume 8
DOI: 10.4172/2165-784X-C1-013

5th World Congress and Exhibition on
CONSTRUCTION AND STEEL STRUCTURE
&
World Congress on
CONCRETE STRUCTURES & CONCRETE TECHNOLOGY
October 05-06, 2018 | Los Angeles, USA

Genda Chen

Missouri University of Science and Technology, USA

Sensor-enhanced analysis and behavior of steel beams in fire

Traditionally, strain data are difficult, if not impossible, to obtain from steel structures in fire due to their harsh environment and temperature measurements are limited to the locations of thermocouples. This paper presents high-temperature measurements using a Brillouin scattering based (distributed) fiber optic sensor and the application of the measured temperatures and material parameters recommended in building codes into the enhanced thermo-mechanical analysis of simply-supported steel beams subjected to combined thermal and loading effects. The distributed temperature sensor captures detailed, non-uniform temperature distributions that are compared locally with thermocouple measurements by less than 5% at a 95% confidence level. The simulated strains and deflections are validated using measurements from a second distributed fiber optic (strain) sensor and two linear potentiometers, respectively. The results demonstrate that the temperature-dependent material properties specified in the four investigated building codes lead to strain predictions with less than 13% average error at 95% confidence level and that the EN1993-1-2 building code provided the best predictions. However, the implicit consideration of creep in the EN1993-1-2 is adequate up to 600°C. More recently, the distributed sensing technology for temperature and strain measurements was applied into small- and large-scale composite floor specimens of a reinforced concrete slab on one or two I-shaped steel beams. The temperature measurements in the reinforced concrete slab were compared with those from limited thermocouples. This paper completes with an experimental investigation of the potential change in the neutral axis of the concrete-steel composite section at elevated temperature.

Biography

Genda Chen received his PhD in 1992 from Civil Engineering at State University of New York at Buffalo. He is Professor and Abbett Distinguished Chair in Civil Engineering and Director of the federal-funded INSPIRE University Transportation Center at Missouri University of Science and Technology. He has published more than 150 papers in reputed journals in the field of structural health monitoring, structural control, and multi-hazard assessment and mitigation. He has been serving as an associate editor of the Journal of Civil Structural Health Monitoring, a section editor of Sensor, and an editorial board member of 5 reputed journals.

gchen@mst.edu

Notes: