Structures Congress 2018

Blast, Impact Loading, and Response; and Research and Education

Proceedings of the Structures Congress 2018

- Fort Worth, Texas
- April 19–21, 2018

ASCE

EDITED BY

James Gregory Soules, P.E., S.E., P.Eng.

SEI ASCE STRUCTURAL ENGINEERING INSTITUTE

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SELECTED PAPERS FROM THE STRUCTURES CONGRESS 2018

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Preface

The Structures Congress has a robust technical program focusing on topics important to Structural Engineers.

The papers in the proceeding are on the following topics

- Advances in Structural Engineering Research
- Analysis, Design & Performance
- Avoiding Disproportionate Collapse
- Bridge Analysis, Design and Repair
- Bridge Management, Inspection and Sustainability
- Building Structures- Case Studies & Concepts
- Buildings - Special Topics in Structures
- Business and Professional Practice
- Codes and Standards - Learn from the Experts
- Design for Lateral Loads/Systems
- Extreme Bridge Loads
- Forensic Investigation
- Long Span Bridges & Vibrations
- Materials- Design & Construction
- Natural Disasters - Moving Toward Improved Resilience
- Nonbuilding Structures and Nonstructural Components
- Special Topics in Structures
- Transformation in SE Education

Acknowledgments

Preparation for the Structures Congress required significant time and effort from the members of the National Technical Program Committee, the Local Planning Committee and staff. Much of the success of the conference reflects the dedication and hard work by these volunteers.

The National Technical Program Committee, the Local Planning Committee and staff would like to acknowledge the critical support of the sponsors, exhibitors, presenters, and moderators who contributed to the success of the conference through their participation.

Thank you for spending your valuable time attending the Structures Congress. It is our hope that you and your colleagues will benefit greatly from the information provided, learn things you can implement and make professional connections that last for years.

Sincerely,

J. G. (Greg) Soules, P.E., S.E., P.Eng, SECB, F.SEI, F.ASCE
CB&I, LLC
Chair, National Technical Program Committee

Contents

Modeling Interactions in Community Resilience

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ABSTRACT

A new platform, based on distributed computing concepts, is proposed with the potential to model the physical, social, and economic interactions that occur during disasters. The platform uses lightweight communications and marshalling (LCM) libraries for message passing and data marshalling thereby enabling various types of simulators to interact together. Each simulator is discipline specific, represents one part of a disaster scenario, and is viewed as a black box that subscribes to data from other simulators and/or publishes its results for other simulators to use. The new LCM framework is versatile and scalable and, as such, enables the developed system to grow through addition of new simulators provided by other users. The new concepts are demonstrated through an introductory case study that is focused on the simulation of wind-induced progressive damage due to both the structural response of the building as well as the external wind pressures.

INTRODUCTION

A community that is resilient to hazards has an understanding of the risks it faces and, through planning and preparation, is able to recover quickly from extreme events. Community resilience is a topic that has gained national attention in the recent past (Chang and Miles 2003, NER 2011, Coulbourne et al. 2014) and involves many dimensions, including engineering, economic, societal, financial, environmental, political, and others. Each of these dimensions is rooted in a specific discipline or spread across a number of closely related disciplines. Modeling the various aspects of these dimensions and the interactions that occur between them during a disaster scenario is necessary to create a meaningful and high fidelity simulation of the event. However, achieving this goal is difficult because of the challenges of transcending disciplinary boundaries.

In this paper, the word ‘simulator’ is used to describe a model that takes an input (subscribes to the information it needs from other simulators) and then produces an output (publishes its results for other simulators to consume). Each simulator represents the contribution of a discipline or sub-discipline within a disaster scenario simulation. Each simulator can run on its own separate computer or cluster of nodes on a network or it can run with other simulators on a single computer. The key idea in this work is that a disaster scenario can be modeled by allowing a group of stand-alone simulators to interact together within a publish-subscribe setting in order to study the effect of simulator behaviors and interactions on community resilience.