

Title: The PEER International Pacific Rim Forum 2021: Regional-Scale Simulations of Earthquake Ground Motions and Infrastructure Response for Performance-Based Earthquake Engineering, June 16-17, 2021

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Motivation

Continued advancements in High Performance Computing (HPC) systems, combined with new understanding and representative models of the physics of earthquake processes, are providing the necessary foundation for unprecedented regional-scale simulations of earthquake ground motions and associated infrastructure response. Emerging regional-scale simulation capabilities offer the potential to explore earthquake processes in virtual space where the impact of various parameters can be fully explored, and ultimately to assist in characterization of the complex regional-scale variations of ground motions and infrastructure response. As this new area develops and advances, it is essential to engage the deep technical discussions necessary to share, compare and contrast the latest technical approaches, software tools and computational workflow for application to regional simulations.

Objectives

The objective of the Pacific Rim Forum was to provide an opportunity for the research and practitioner communities to take stock of the current status of regional-scale simulations, to identify remaining challenges to achieving realistic and accurate simulations, and to provide an opportunity to discuss the appropriate pathway to begin bringing regional simulations into engineering practice.

Methodology

The forum consisted of two days of presentations on the latest physics models, algorithms, software and computational workflow for regional-scale simulations. Presentations spanned the multidisciplinary space from seismology to geotechnical to structural engineering. Technical sessions were organized around each of the key elements of fault-to-structure simulations and confidence building in simulation results. On the second day important discussions were conducted on the appropriate pathway for bringing regional-scale simulations into Performance-Based Earthquake Engineering practice.

Results

In the first day of the Forum a wealth of information from leading international researchers was presented and this information has been captured in presentation slides as well as videos of each presentation. This information highlighted the current state of the art computational capabilities and remaining technical challenges. In the second day the topics shifted to framing the necessary elements of simulation validation and characterization of uncertainties that will be necessary to raise confidence in the use and application of simulated ground motions. The final sessions, which were informed by the two days of deep-dive technical presentations, were focused on

group discussions on the needs and the correct pathways to help ensure that regional simulations can be appropriately ushered into earthquake engineering practice.

Conclusions

PEER has a timely and important opportunity to address the consensus need for creating a detailed and effective database of regional-scale simulated ground motions that can be appropriately stored and managed for open access by the broad earthquake science and engineering communities. PEER's experience with management and distribution of measured earthquake data can be readily extended to include the emerging high-resolution datasets from regional-scale simulations.

Keywords: regional-scale earthquake simulations, fault-to-structure models, ground motion validation, geophysics-engineering model coupling, regional earthquake risk assessment, Performance-Based Earthquake Engineering

Figure

