

**Damage Detection in Buildings Using
Wave Propagation Methods and the Community Seismic Network**

Dr. Monica Kohler

Research Assistant Professor, Department of Mechanical and Civil Engineering, Caltech

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Abstract:

Seismic techniques applied to arrays of seismometers deployed on the surface of the Earth have been successful for decades at imaging seismic velocity variations within the solid Earth, from delineating oil reservoirs to identifying inelastic, non-isotropic seismic heterogeneity in the deep Earth. I will discuss an approach that leverages the success of seismic imaging techniques to numerically test damage detection methods on computational models of buildings. The goal is to identify and localize defects corresponding to damage immediately following a moderate or strong earthquake. The study focuses on numerically modeling the pre-event and post-event properties of direct seismic waves using Helmholtz tomography. Damage detection methods are numerically tested on computational finite-element scenario “damaged” and “undamaged” model responses of buildings that are also currently instrumented by strong-motion networks. This study is motivated by the fact that low-cost sensors are now making it possible to instrument buildings on a floor-by-floor scale, and to record continuous vibration data at high sample rates. The Community Seismic Network is one of these low-cost networks, expanding at a steady rate and now consisting of 800 active accelerometer sensors deployed in the urban regions of the greater Los Angeles area, including on nearly every floor of several buildings. The continuously recorded data can be used to examine the building responses to vibration events such as wind storms and explosions, in addition to earthquakes, in order to assess potential damage.

Bio:

Monica Kohler received her Ph.D. in geophysics from Caltech in 1995. She is currently a Research Assistant Professor in the Department of Mechanical and Civil Engineering at Caltech. Prior to that she held research positions in the Department of Earth and Space Sciences at UCLA and at the Center for Embedded Networked Sensing based in the Department of Computer Sciences at UCLA. She is on the science leadership team of the Community Seismic Network project developed and operated at Caltech.