

Mini-symposium on Current and Future Needs in Sub-microscale Vibration Analysis
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Abstract

Since Richard Feynman's 1959 lecture at Caltech, "*There's Plenty of Room at the Bottom*," progress in nanotechnology has made modern life increasingly dependent on tools and processes that demand strict operational requirements under severe environmental disturbances. The need for sensitive instruments in semiconductor, space exploration, pharmaceutical, and research laboratories with ever more refined precisions calls for new methods of analysis and design that drive the state-of-the-art in sub-microscale vibration mitigation. As size of physically observable quantities decrease noise and signal become indistinguishable rendering classical methods of measuring and control too expensive or implausible. Space applications are currently pursuing very large deployable observatories capable of sub-atomic stability over periods of days. Another example is pyro-shock applications for which structural response subject to very high-frequency transient loads depends on complex multi-scale physics.

This mini-symposium is proposed as a forum for collecting relevant problems in sub-microscale vibration analysis in a coherent theoretical and application-driven framework. It is also envisioned as initiation of efforts in developing novel methods of solution and disseminating new results in a joint special issue of the ASCE Journals of Engineering Mechanics and Structural Engineering.

The list of presentation topics includes but is not limited to:

- The theoretical and computational predictive accuracy of analysis (*e.g.*, finite element limitations, quantification of modeling uncertainty),
- New methods of sub-microscale vibration measurement and model validation (*e.g.*, carbon nanotubes, optical methods),
- Emerging methods of analysis (*e.g.*, lattice dynamics, atomistic finite elements),
- Probabilistic methods and random vibrations,
- Potentials for machine learning, and
- Vibration control and attenuation strategies.

The subject of sub-microscale vibration analysis and control is particularly attractive for the EMI Conference at Caltech given the historic and seminal contributions of the Institute to vibration analysis, nanotechnology, and space exploration; many of which will be showcased during this mini-symposium.

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