PERIODIC MATERIAL-BASED SEISMIC ISOLATION FOR UNDERGROUND STRUCTURES

Summary

The science behind a building collapsing during an earthquake is mostly a consequence of matching a building's natural frequency to that of the frequency of the earthquake. When they match, the building is more vulnerable to collapsing. Each building and underground structure has its own, unique natural frequency, but earthquakes come in a range of frequencies and magnitudes.
Predicting the frequency of every future earthquake is nearly impossible, but knowing the natural frequency of a particular building or underground structure becomes a tool when designing phononic structures as protection from earthquakes. Phononic structures have periodicity to vibrational energy and, by design, can deflect the energy of an earthquake when the earthquake's frequency matches the periodicity of the phononic structure. This technology shows how phononic structures made from simple materials such as steel, rubber, and concrete can have frequency-specific periodicity and become barriers to seismic energy of practically any magnitude but within a particular range of frequency. This technology can be used in the foundation of a building or as an underground barrier to sensitive, underground structures such as nuclear power plants.

Competitive Advantages

- This seismic protection system deflects the band gap of energy that is most sensitive to a particular underground structure in-turn providing earthquake protection from all future earthquakes
- Sensitive, underground structures such as nuclear power plants and nuclear arsenals could be protected with this technology

Meet the Inventor

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Research Interests:

- Primary research interests are related to the behavior and design of Reinforced/ Prestressed Concrete, Steel, Hybrid and Composite Structures subjected to seismic and blast loads.

Problem Addressed

- Other methodologies just absorb energy and therefore cannot provide complete protection
- Underground structures do not benefit from existing seismic isolation methodologies

Applications

- Underground military bases and government structures
- Underground nuclear power plants
- Underground commercial buildings and structures in sensitive areas such as California

Patents

- US, 62/289,419
- PCT/US2017/016003

Publication

- Y. L. Mo et al.; Smart Materials and Structures 2015; V24, N7

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