The seminar will be held at Roma Tre University
Department of Engineering - via Vito Volterra, 62, Rome
Wednesday 3 February 2015 - Seminar Room - 11:30-12:30
Metaconcrete: Engineered aggregates for enhanced dynamic performance

Abstract. Recent progress in the field of metamaterials science has led to a range of novel composites which display unusual properties when interacting with electromagnetic, acoustic, and elastic waves. Metaconcrete is a new structural metamaterial with enhanced wave attenuation properties for dynamic loading applications. In this new composite material the standard stone and gravel aggregates of regular concrete are replaced with spherical engineered inclusions. Each metaconcrete aggregate has a layered structure, consisting of a heavy core and a thin compliant outer coating. This structure allows for resonance at or near the eigenfrequencies of the inclusions, and the aggregates can be tuned so that resonant oscillations will be activated by particular frequencies of an applied dynamic loading. The activation of resonance within the aggregates causes the overall system to exhibit negative effective mass, which leads to attenuation of the applied wave motion. To investigate numerically the behavior of metaconcrete slabs under a variety of different loading conditions a finite element slab model containing a periodic array of aggregates is utilized. The various analyses presented in our studies provide the theoretical and numerical background necessary for the informed design and development of metaconcrete aggregates for dynamic loading applications, such as blast shielding, impact protection, and seismic mitigation. The work has been developed in collaboration with Stephanie J. Mitchell (Caltech), Michael Ortiz (Caltech) and Deborah Briccola (Polimi).

References

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