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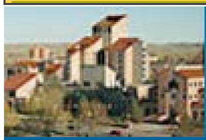

AEROSPACE ENGINEERING SCIENCES

Seminar

Kathryn Matlack

Postdoctoral Researcher, Department of Mechanical and Process Engineering
ETH Zurich

Architected elastic meta-structures

Architected materials have the ability to manipulate and control stress wave propagation, which is essential for enhanced vibration mitigation, sound attenuation, and impact absorption properties. Recent research has relied on two mechanisms for engineering band gaps to forbid certain frequencies from propagating through a material: (1) phononic crystals rely on their structural periodicity to form Bragg band gaps at wavelengths on the order of their unit cell size; (2) acoustic metamaterials exploit local resonances to form narrow band gaps at low frequencies. However, existing materials find limited use in engineering applications because they cannot achieve both broadband and low frequency control of elastic or acoustic waves without requiring impractical sizes and masses. Here, I introduce a new class of materials, labeled elastic meta-structures, that supports the formation of wide band gaps at low frequencies, by exploiting resonating elements to broaden and lower Bragg gaps, while simultaneously reducing the mass of the system. Analytical and finite element modeling is used to simulate wave propagation through these structures and inform the designs. These principles are demonstrated experimentally using novel 3D printing methods to fabricate functional composite meta-structures on multiple length scales. This research informs the design of tailored materials that can effectively control elastic wave propagation, resulting in increased efficiency of aerospace structures, robust and lightweight sound absorbers for buildings, and protection of structures from harmful impacts.

Monday, February 29, 2016
12:00 Noon
Onizuka Conference Room

Refreshments!

Bio: **Dr. Kathryn Matlack** is a postdoctoral researcher at ETH Zurich in the Department of Mechanical and Process Engineering. She was awarded the ETH Postdoctoral Fellowship for her research on elastic metamaterials for vibration absorption and wave guiding applications. She received her B.S. in mechanical engineering from MIT, and her Ph.D. in mechanical engineering from the Georgia Institute of Technology where she was an NSF Graduate Research Fellow. She was awarded the Sigma Xi Best Ph.D. Thesis for her research on developing a nonlinear ultrasonic technique to monitor radiation damage in nuclear reactor structural material.