



UNIVERSITY  
OF TRENTO - Italy

Department of Civil, Environmental  
and Mechanical Engineering



EXTREME LOADING ANALYSIS OF  
PETROCHEMICAL PLANTS AND DESIGN OF  
METAMATERIAL-BASED SHIELDS FOR ENHANCED  
RESILIENCE



<http://r.unitn.it/en/dicam/xp-resilience>

## SEMINAR ANNOUNCEMENT

The following seminar will be organised on 08.07.2019 at 11.30 in room 1H

### Elastic metamaterials and metasurfaces for surface ground motion mitigation.

#### Antonio Palermo

*Postdoctoral Fellow in the Department of Civil, Chemical, Environmental and Materials  
Engineering at the University of Bologna*

#### Abstract:

Elastic metamaterials are artificial composites with resonant elements hosted in a medium able to manipulate the propagation of elastic waves, e.g. surface and bulk waves. When the resonant elements are placed on the free surface of an elastic medium, they form a “metasurface” that allows to fully control the dynamics of surface waves. In this talk, I will discuss the use of resonant metamaterials to attenuate the propagation of surface waves and their possible application as building blocks of a resonant barrier against seismic waves and ground-borne vibrations. First, I will describe the dynamic interaction of Rayleigh waves with a metasurface of vertical resonators and the design principles of large-scale barriers able to deflect seismic Rayleigh waves into the medium bulk. The barrier design is guided by an analytical model able to predict the frequency range where Rayleigh waves are attenuated. Numerical models and experimental evidences from a small-scale test are presented to validate the analytical predictions. Then, I will highlight the effect of soil stratification on the metasurface dynamics by analyzing the propagation of surface waves in granular media with depth-dependent stiffness profile. Finally, I will show how analogous resonant systems can be applied to mitigate the propagation of shear polarized waves, e.g. bulk and Love waves, and discuss their capabilities in mitigating site amplification effects.

#### Short Biography:



Antonio Palermo is a Postdoctoral Fellow in the Department of Civil, Chemical, Environmental and Materials Engineering at the University of Bologna. He received his Civil Engineering degree from the University of Bologna (2011), a MSc in Earthquake Engineering from Imperial College (2013), UK, and a Ph.D in Structural Engineering from the University of Bologna (2017). In 2018, he joined the Department of Mechanical and Civil Engineering at the California Institute of Technology as a “Cecil and Sally Drinkward Postdoctoral Fellow”. His research interests lie at the intersection between solid mechanics, applied physics, and civil engineering with the aim of designing novel materials and structures for elastic wave propagation control. He is the recipient of the “Claudio Bonivento Thesis Prize for Research and Technological Innovation-ISA” (2018) and the “Medaglia Leonardo Da Vinci-MIUR” (2019).



UNIVERSITY  
OF TRENTO - Italy

Department of Civil, Environmental  
and Mechanical Engineering

The seminar is organised by the XP-RESILIENCE research group

<http://r.unitn.it/en/dicam/xp-resilience>

Prof. Oreste S. Bursi

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 721816