



UNIVERSITÀ DEGLI STUDI  
DI PERUGIA



DIPARTIMENTO DI INGEGNERIA  
CIVILE E AMBIENTALE  
DIPARTIMENTO DI ECCELLENZA

# CIVIL AND ENVIRONMENTAL ENGINEERING

## DOCTORAL PROGRAM

### SMART MATERIALS FOR INTERACTIVE ENVIRONMENTS AND INTELLIGENT STRUCTURES

**Instructors:** Luca Valentini, Ph.D., Associate Professor, University of Perugia and Filippo Ubertini, Ph.D., Full Professor, University of Perugia

**Course Description:** This course is a broad introduction to the principles of functioning of functional nanomaterials, with their operation in a variety of sensor architectures and modalities, including pressure, strain, thermal, optical and bioelectric. Illustrative applications in practical engineering problems, such as monitoring civil engineering structural components using smart concretes and smart bricks will be discussed. Students are required to complete a set of laboratory tests, and a final project consisting of the proposal of a smart monitoring network for a civil engineering problem using smart materials.

**Evaluation:** Students will be evaluated through a take-home exam.

#### May, 18th 2020

9:30-13:30 Self-monitoring nanomaterials: principles of functioning (2 hrs class, 3 hrs lab). Luca Valentini.

#### May, 25th 2020

9:30-13:30 Processing and integration methods of nanomaterials in the construction industry (2 hrs class, 3 hrs lab). Luca Valentini.

#### June, 1st 2020

9:30-13:30 Nano-elastomers for high value products in several large scale industrial applications: some relevant case studies (2 hrs class, 3 hrs lab). Luca Valentini.

#### June, 9th 2020

9:30-13:30 Bionicomposites: the grand challenge in the construction industry (2 hrs class, 3 hrs lab). Luca Valentini.

#### June, 25th 2020

9:30-10:30 Nanomaterials in the construction industry: environmental health and safety considerations. Luca Valentini.

#### June, 29th 2020

9:30-13:30 Self-sensing concretes and smart bricks for structural engineering applications (4 hrs class, 1 hr lab). Filippo Ubertini.

#### July, 1st 2020

9:30-13:30 Sensing skins for large area monitoring. Smart pavements for bridge WIM (3 hrs class, 2 hrs lab). Filippo Ubertini.



Luca Valentini received his Master's degree in Physics from the University of Perugia and his PhD degree in Materials Science from the University of Napoli "Federico II". He is Associate Professor of Materials Science and Technology at the University of Perugia and chair of the courses of Applied Mechanics, Materials Technology and Laboratory of Materials at the University of Perugia. He is author of more than 160 publications in international journals with citation index in the fields of materials science, polymer physics and bionic composites. He is member of the Graphene Flagship and Associate Editor of Polymer and Composite materials topic of the journal Frontiers in Materials.



Filippo Ubertini received his Master's degree in Civil Engineering from the University of Perugia and his PhD degree in Civil Engineering from the University of Pavia. He is Professor of Structural Design at the University of Perugia and chair of the courses of Advanced Structural Design and Structures for Industrial Design at the University of Perugia. Author of more than 75 papers published in high impact international journals, his research is mainly focused on structural health monitoring, with emphasis on smart materials and applications to earthquake engineering and cultural heritage structures. He is a member of the editorial boards of: Sensors, Advances in Civil Engineering, Shock and Vibration, Mathematical Problems in Engineering and Engineering Research Express.

**Location:** Campus of Engineering of University of Perugia  
Latitude: 43.118177 Longitude: 12.357942

**Timetable:** May 18-July 1 9:30 a.m. - 1:30 p.m.,  
Room 10

