Title: **Principles of Structural Control for Civil Engineering**

Instructors**:** Julian Londono Monsalve (JLM), Dimitrios Konstantinidis (DK), Daniele Losanno (DL)

Summary: This course will explore the principles and applications of passive, semiactive and active control systems in civil engineering. Through a combination of theoretical lectures and practical sessions, students will gain a deep understanding of how these control systems can enhance the resilience and performance of civil infrastructures.

Course venue**:** University of Napoli Federico II, Department of Structures for Engineering and Architecture.

Date: May 26th to 30th, 2025

Credits: 3 CFU

Duration: 24 hours

Syllabus:

Day	Time	Instructor	Topic
Mon 26th	8:30 – 11:00	DL	**Introduction to Active, semiactive and Passive Control Systems** - Types of structural vibrations - Energy balance equation for controlled system - Overview of control systems in civil engineering - Key differences between active and passive control
	11:30-14:00	JLM	**Introduction to Active Vibration Control systems** - Architectures (SIMO, MIMO, etc) and definitions (open/close loops) - Implementation requirements (Hardware needs and practical considerations) **Control System Modelling** - Mathematical modelling of dynamical systems - Fourier Analysis: moving across the time/frequency Domains - Understanding FRF, bode diagram and other tools - Laplace transform and its uses in dynamics - Feedforward/feedback control governing equations
Tue 27h	8:30 – 11:00	JLM	**Control Algorithms for active control** - Direct velocity feedback. - PID, modal state-space control - Optimal Linear Control - Pole placement - Semi-active Control Algorithms (AMD-MRs)
	11:30-14:00	DL	**Passive control systems** - General overview - Overview of seismic isolation (concept, history, device types, projects) - Design strategy for base isolation and supplemental damping - Classification of devices
Wed 28th	8:30 – 11:00	JLM	**Control System Simulation using Matlab** - Stability of controlled systems - Root Locus analysis - Pole placement method
	11:30-14:00	DK	**Seismic isolation (1/3)** - The linear theory of seismic isolation (2-DOF and MDOF extension) - Response analysis of seismically isolated structures - Design properties of seismic isolation devices
Thur 29th	8:30 – 11:00	DK	**Seismic isolation (2/3)** - Design properties of seismic isolation devices (cont.) - Nonlinear modelling and response history analysis of isolated structures - Mechanical behavior of seismic isolators
	11:30-14:00	DL	**Supplemental damping systems** - Design of rate-dependent devices - Design of rate-independent devices - Design criteria
Fri 30th	8:30 – 11:00	DK	**Seismic isolation (3/3)** - Mechanical behavior of seismic isolators (cont.) - Stability of seismic isolators
	11:30-13:00	DL	**Dynamic vibration adsorbers** - Tuned Mass Dampers - Active Mass Dampers

Teaching mode:

- In person:
  Multimedia Room, Building #7, Via Claudio 21, Napoli
  Univ. of Napoli Federico II, Department of Structures for Engineering and Architecture
  https://www.google.com/maps/dir/Universit%C3%A0+degli+Studi+di+Napoli,+Via+Claudio,+21,+Napoli,+NA/Universit%C3%A0+degli+Studi+di+Napoli/@40.8276699,14.1905847,663m/data=!3m1!1e3!4m13!4m12!1m5!1m1!1s0x133b0ecd04123677:0xa90f86f098dc985!2m2!1d14.1898227!2d40.8291696!1m5!1m1!1s0x133b0ecd04123677:0xa90f86f098dc985!2m2!1d14.1898227!2d40.8291696?entry=ttu&g_ep=EgoyMDI1MDMyNS4xIKXMDSoASAFQAw%3D%3D
- Online on MS Teams:
  Short Course on "Principles of Structural Control for Civil Engineering" - May 26th - 30th 2025 | Generale | Microsoft Teams

How to enroll: send an email to phd.dist@unina.it copying daniele.losanno@unina.it, konstantinidis@berkeley.edu and J.Londono-Monsalve@exeter.ac.uk

SHORT BIO

Julian Londono Monsalve is a Senior Lecturer in Mechanical Engineering and the programme lead for the MSc in Mechanical Engineering at the University of Exeter with a long track record in experimental nonlinear dynamics. He was awarded a MEng cum laude in Civil Engineering in 2000 and MSc in Industrial Automation in 2006 from the National University of Colombia. Funded by a prestigious AlBan scholarship, Dr. Londono completed his PhD in Structural Engineering in 2010 at the University of Naples Federico II. His main research interests cover Vibration-based nonlinear system identification, Experimental nonlinear dynamics, Modal Testing and Real-Time Hybrid Testing (Hardware in-the-loop), and Structural control for vibration suppression.

https://experts.exeter.ac.uk/25416-julian-londonomonsalve

Dimitrios Konstantinidis is an Associate Professor in the Department of Civil and Environmental Engineering at the University of California, Berkeley. His expertise lies in earthquake engineering and engineering mechanics, with research mainly focused on advancing seismic isolation and structural control technologies, and improving the seismic performance of nonstructural components. His work combines experimental testing and mathematical modeling to better understand and characterize mechanical behavior, develop innovative protection strategies, and shape improvements in seismic design codes and standards. He currently serves as a voting member on the ASCE 7-28 Seismic Subcommittee and contributes to its Task Committees on Seismic Isolation and Energy Dissipation and on Nonstructural Components. Among his publications is the book *Mechanics of Rubber Bearings for Seismic and Vibration Isolation*.

https://ce.berkeley.edu/people/faculty/konstantinidis

Daniele Losanno is an Assistant Professor (tenure-track) in the Department of Structures for Engineering and Architecture at the University of Napoli Federico II, Italy, where he received his PhD in 2015. He has been involved in several research projects on low cost protection systems including innovative rubber isolators and metallic yielding devices. His research interests cover optimal design strategies for seismically isolated bridges and multi-story buildings equipped with supplemental damping systems. Recently, he received funding from the European Union within Horizon Europe 2020-2027 programme (ERIES-FREISUST) for a 3D shaking table testing program on a full-scale base isolated 2-storey R.C. building. Additional research areas encompass assessment and retrofit of R.C. bridges, experimental testing and numerical modelling of prestressed R.C. girders, structural health monitoring.

https://www.docenti.unina.it/#!/professor/44414e49454c454c4f53414e4e4f4c534e444e4c38375330354135303946/riferimenti