| Course | Lecturer | About the course |
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| Introduction to the Nonlinear Structural Dynamics | **J. N. Reddy**<br><br>Regents' Professor, The holder of the O'Donnell Foundation Chair IV in Mechanical Engineering, Texas A&M University, College Station, Texas | This part of the course is intended to provide engineers/scientists with the theory of the finite element method and its use in the solution of linear and nonlinear problems from solid and structural dynamics. The primary goal is to engage participants in the understanding of formulative and analysis aspects of structural dynamics using the finite element method. The present course is designed to bridge the gap between the theoretical finite element knowledge and its applications by providing sufficient insights into the physical principles, the finite element approximation theory, and implementation ideas (e.g., review governing equations, develop finite element models, and illustrate through meaningful examples taken from solid and structural mechanics topics like beams and plates). |

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| Information Systems for Strengthening City Seismic Resilience | **Muneo Hori**<br><br>Director General, Research Institute for Value-Added Information Generation, Japan Agency for Marine-Earth Science and Technology, Kanagawa, Japan | The course covers three information systems that are developed to strengthen city resilience of natural disasters including earthquakes and tsunami. The system of primary importance is a digital twin, which consists of large-scale high-fidelity analysis models of important structures, cities and regions and carries out physics-based numerical simulations enhanced with high performance computing capabilities for given hazard scenarios or observed hazard data. Fundamental elements of the physics-based simulation are explained, focusing on the application of continuum mechanics, applied mathematics and computational science. The other two information systems are 1) an information sharing system of central and local governments which automatically collect, assemble and transform various information about hazards and disasters; and 2) a satellite data system that provides regional scale hazard and disaster information using all available satellites in a few hours after a natural disaster happens to make most efficient initial actions against the disaster. |

| Course | Lecturer | About the course |
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| Seismic Resilience of Foundation-Structure Systems | **Ioannis Anastasopoulos**  Head, Dept. of Civil, Environmental and Geomatic Engineering,Chair of Geotechnical Engineering, ETH Zürich | The course will offer an introduction to geotechnical earthquake engineering and an overview of our research on the seismic resilience of foundation-structure systems. We will start with an introduction to soil dynamics, ground response, and dynamic soil properties, followed by the more specialized topics of site effects and soil liquefaction, as well as dynamic soil-structure interaction. In the second part of the course, we will focus on recent developments on the subject of seismic resilience of foundation-structure systems, including rocking foundations, the retrofit of existing bridge pilegroups, the seismic response of offshore foundations, and the Tsunami-induced failure of breakwaters. |

| Course | Lecturer | About the course |
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| Improving Resilience through Seismic Devices | **Fabio Freddi**<br><br>Associate Professor in Structural Engineering<br>Department of Civil, Environmental & Geomatic Engineering (CEGE)<br>University College London | Traditional seismic design strategies included in current codes are based on energy dissipation related to construction damage, often leading to considerable direct and indirect losses as a consequence of 'rare' (i.e., high intensity) seismic events. Additionally, the inelastic deformations in the structural components can lead to large residual deformations, thus impairing the repairability of the constructions. This situation strongly affects the overall resilience of communities in seismic-prone regions, especially when the damaged structures include strategic transportation facilities, such as bridges or tunnels connecting essential services that must remain operational in the aftermath of a damaging earthquake. To overcome this issue, several recent research works investigated innovative solutions for the design of seismic-resilient structures, chasing the objectives of minimising both seismic damage and repair time, hence allowing the definition of structures able to go back to the undamaged, fully functional condition in a short time, enhancing structural resilience. The course presents some of the recent research advancements, including experimental, numerical, analytical, and probabilistic studies on some novel solutions allowing the definition of damage-free self-centring structures. |

| Course | Lecturer | About the course |
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| Intelligent Earthquake Disaster Detection and Prediction for Buildings | **Ying Zhou**<br><br>Dean, College of Civil Engineering, Tongji University<br>Director, International Joint Research Laboratory of Earthquake Engineering | The rapid advancements in computer and artificial intelligence technologies have facilitated the integration of increasingly sophisticated intelligent solutions within the interdisciplinary research and applications of civil engineering. Compared to traditional civil engineering techniques, structural intelligent disaster prevention has demonstrated significant improvements in work efficiency and accuracy, emerging as a crucial development direction within this interdisciplinary field. This course aims to provide a comprehensive overview of research pertaining to the intelligent detection and response prediction of building structure, focusing on three key aspects: intelligent detection and evaluation of localized damage within building structures, intelligent detection and evaluation of overall structural damage, and I ntelligent prediction of building structure response. The course encompasses diverse topics such as automatic damage detection utilizing artificial intelligence algorithms and unmanned aerial vehicles (UAVs), identification of dynamic characteristics of structures through the fusion of computer vision and artificial intelligence techniques, investigation of intelligent response prediction algorithms for structures employing Transformer models, and an introduction to resilience evaluation methods. The course underscores recent research breakthroughs in the domain of intelligent earthquake disaster detection and response prediction for buildings, including the development and implementation of state-of-the-art AI algorithms, coupled with corresponding experimental validations. |

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<tr><th>Course</th><th>Lecturer</th><th>About the course</th></tr>
<tr><td>Next-generation Smart, Carbon-Neutral and Resilient Infrastructure and Construction</td><td>Tony Yang<br><br>Professor, Department of Civil Engineering<br>Director, Smart Structures Laboratory<br>The University of British Columbia, Vancouver, Canada</td><td>Civil infrastructure is facing significant demands from rapid population growth, aging and natural disasters. The next-generation civil infrastructure needs to be smart, carbon-neutral and resilient. This presentation presents the state-of-the-art technologies in high-performance, carbon neutral, earthquake resilient structural systems, and AI inspections and robotic construction.</td></tr>
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