

Soil-structure interaction in OpenSees *strategies, applications and perspectives*

Winter school – 7-10 February 2023

Soul and goal

The open-source analysis framework OpenSees (<https://opensees.berkeley.edu/>) is an evolving numerical environment for an advanced assessment of civil structures against natural hazards. The increasing development of OpenSees in the field of soil-structure interaction makes it particularly suitable towards multi-disciplinary approaches. A platform that meets the need to account for the dominant features of soil-structure interaction in the prediction and control of structural vibration under dynamic loading conditions.

A four-day workshop to explore the basics and advanced applications of soil-structure modelling in OpenSees, focussing on critical issues of the implementation and discussing possible solutions. Facilitating the first use of OpenSees as well as developing nonlinear dynamic analyses on large-scale domains are the crucial points of this path, going together along the modelling techniques with reference to relevant soil-structure interaction problems. A meeting point to interact within the vast world of dynamics of soil-structure systems, for sharing experience and pointing out new horizons.

Organising committee

Dr. Davide Noè Gorini (Sapienza University of Rome, Italy)

Prof. Luigi Callisto (Sapienza University of Rome, Italy)

Prof. Paolo Franchin (Sapienza University of Rome, Italy)

Dr. Tony Fierro (University of Molise, Italy)

Invited Speakers

Prof. Pedro Arduino (University of Washington, United States)

Prof. Frank McKenna (University of California, Berkeley, United States)

Prof. Christopher McGann (University of Canterbury, New Zealand)

Prof. José Abell (University of the Andes, Chile)

Dr. Domenico Gallese (ARUP engineering company, England)

Prof. Federico Pisanò (Delft University of Technology, Netherlands)

Prof. Anastasios Sextos (University of Bristol, England)

Dr. Tim Cockerill (Texas Advanced Computing Center, United States)

Eng. Giuseppe Lombardi (Sapienza University of Rome, Italy)

Dr. Andrea Marchi (Sapienza University of Rome, Italy)

Dr. Massimo Petracca (Università degli Studi G. d'Annunzio Chieti e Pescara, Italy)

Eng. Pasquale Roberto Marrazzo (University of Salerno, Italy)

Dr. Amedeo Flora (University of Basilicata, Italy)

Scientific programme

Day 1 - Tuesday, Feb 7

9.30-10.00 **Registration and Opening**

10.00-12.00 *Methods of analysis for soil-structure interaction problems*, L. Callisto

Session 1: basics of modelling soil-structure interaction in OpenSees

12.15-12.45 *Introduction to OpenSees*, D. N. Gorini

14.00-15.30 *Modelling the main components of a soil-structure system*, D. N. Gorini

Session 2: pre- and post-processing large domains

16.00-16.45 *Matlab & OpenSees*, D. Gallese and G. Lombardi

17.00-18.00 *GiD & OpenSees*, D. N. Gorini and D. Gallese

18.15-19.15 *STKO*, M. Petracca

Day 2 - Wednesday, Feb 8

Session 3: parallel computing: general settings and optimisation

8.30-9.00 *Applications for parallel computing*, D. N. Gorini

9.15-9.45 *Partition strategies: domain decomposition and parallel analyses*, J. Abell

10.15-10.45 *Optimisation of numerical computing*, D. N. Gorini

11.00-11.30 *Scripts for parallel computing: differences from sequential computing*, D. Gallese

11.45-12.15 *Super-computing resources: the new horizon of the Texas Advanced Computing Centre*, T. Cockerill

Session 4: developing OpenSees

12.30-13.30 *Implementing a finite element*, P. Arduino

14.30-15.15 *Brick elements with hydro-mechanical coupling*, C. McGann (remotely)

15.30-16.00 *Implementing a multiaxial material*, T. Fierro

16.30-17.00 *Integration schemes: existing methods and perspectives*, J. Abell

17.15-17.45 *Embedded foundations: soil-structure contact through embedded finite elements*, D. Gallese

18.00-18.30 *Implementing macroelements for soil-structure interaction*, D. N. Gorini

18.45-19.45 *SimCenter scientific workflow systems and connection to DesignSafe infrastructure*, F. McKenna (remotely)

Day 3 - Thursday, Feb 9

Session 5: geo- and structural materials: calibration and use

9.00-9.30 *Advanced materials for coarse-grained soils*, P. Arduino

9.45-10.15 *Advanced materials for fine-grained soils*, C. McGann (remotely)

10.45-11.15 *A broader class of bounding surface plasticity models for soil*, T. Fierro and D. N. Gorini

11.30-12.00 *Bearing and anti-seismic devices*, A. Flora

12.15-12.45 *Soil-structure interfaces*, D. N. Gorini

Session 6: construction sequence and boundary conditions

14.00-14.30 *Coupled modelling of soil-structure domains: strategies*, D. N. Gorini

14.45-15.15 *Coupled modelling: boundary conditions*, D. Gallese

15.30-16.00 *Domain reduction method*, J. Abell

16.30-17.00 *Macroelement modelling: staged analysis procedure and soil mass participation*, D. N. Gorini

17.15-18.00 *Staged analysis using discontinuous, distributed soil-structure macroelements*, A. Marchi

Day 4 - Friday, Feb 10

Session 7: useful numerical procedures

8.45-9.45 *Parametric mesher for soil-structure systems*, D. N. Gorini and G. Lombardi

10.00-10.30 *Modal analysis of soil-structure systems*, D. Gallese

Session 8: OpenSees and soil-structure interaction: an ever-broader horizon

11.00-11.30 *Importance of the site response*, T. Fierro

11.45-12.15 *Soil-foundation interaction and hydro-mechanical coupling*, G. Lombardi

12.30-13.15 *Offshore foundations*, F. Pisanò (remotely)

14.15-15.00 *Multi-hazard assessment of offshore wind turbines*, A. Sextos

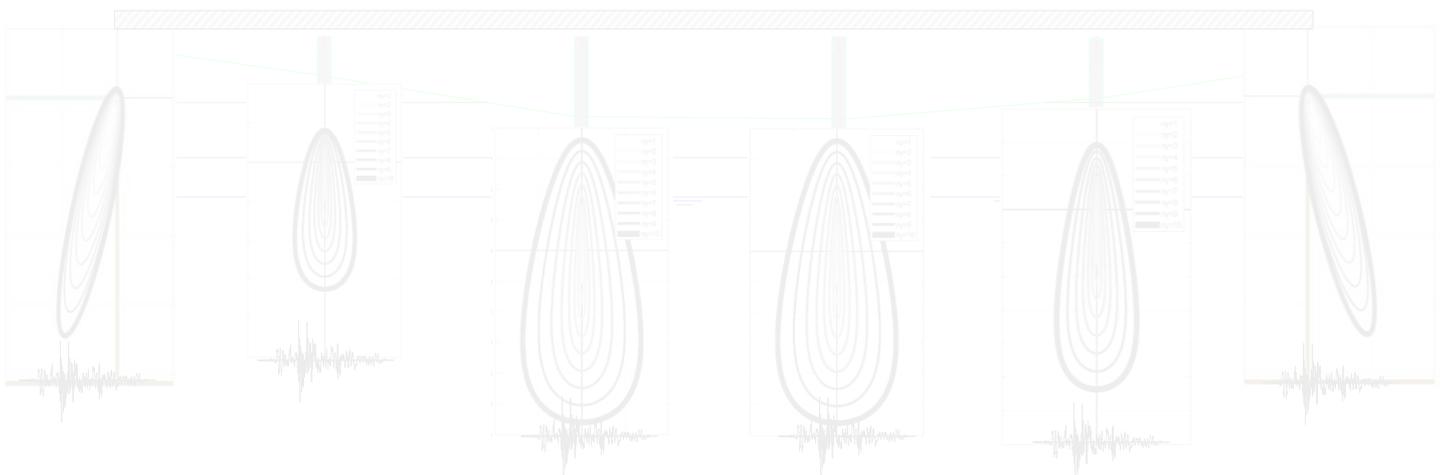
15.15-15.45 *Soil-piles interaction*, D. Gallese

16.00-16.30 *Soil-tunnel interaction*, G. Lombardi and D. N. Gorini

17.00-17.45 *Soil-abutment-superstructure interaction*, D. N. Gorini and A. Marchi

18.00-18.30 *Anti-seismic soil-structure systems*, D. N. Gorini and P. R. Marrazzo

18.45-19.00 **Closing**



Organising Committee

Davide Noè GORINI
Luigi CALLISTO
Paolo FRANCHIN
Tony FIERRO



Dr. Davide Noè Gorini

Post-doctoral researcher at Sapienza University of Rome (corresponding: davideno.gorini@uniroma1.it)

Research interests: seismic assessment of soil-structure systems based on thermodynamic inertial macroelements; seismic performance of bridges, buildings and tunnels; development of computational tools for civil engineering applications in OpenSees; analysis and design of anti-seismic solutions and dissipative foundations; thermodynamic-based constitutive laws for geomaterials; seismic assessment of natural slopes.

Prof. Luigi Callisto

Full Professor at Sapienza University of Rome

Research interests: methods for seismic design of retaining structures and foundations; seismic behaviour of earth dams; behaviour of deep excavations; dynamic soil-structure interaction for bridge foundations; limit state analysis of geotechnical systems.

Prof. Paolo Franchin

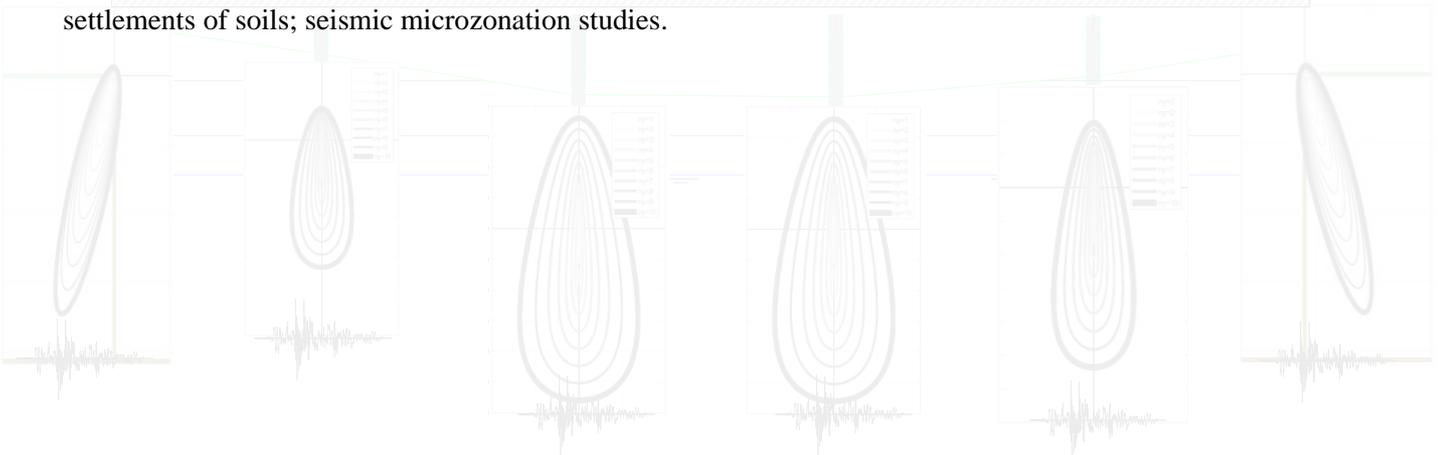
Full Professor at Sapienza University of Rome

Research interests: structural reliability; methods for seismic design of buildings and bridges; methods for the safety assessment of existing buildings and bridges; dynamic soil-structure interaction; probabilistic risk assessment of interconnected infrastructure systems.

Dott. Tony Fierro

Post-doctoral researcher at University of Molise

Research interests: implementation of constitutive models in OpenSees; constitutive modelling for geomaterials; site response analysis of complex soil domains; assessment of liquefaction triggering in soil; post-cyclic behaviour of liquefiable soils in the case of buried pipelines; evaluation of seismic-induced settlements of soils; seismic microzonation studies.

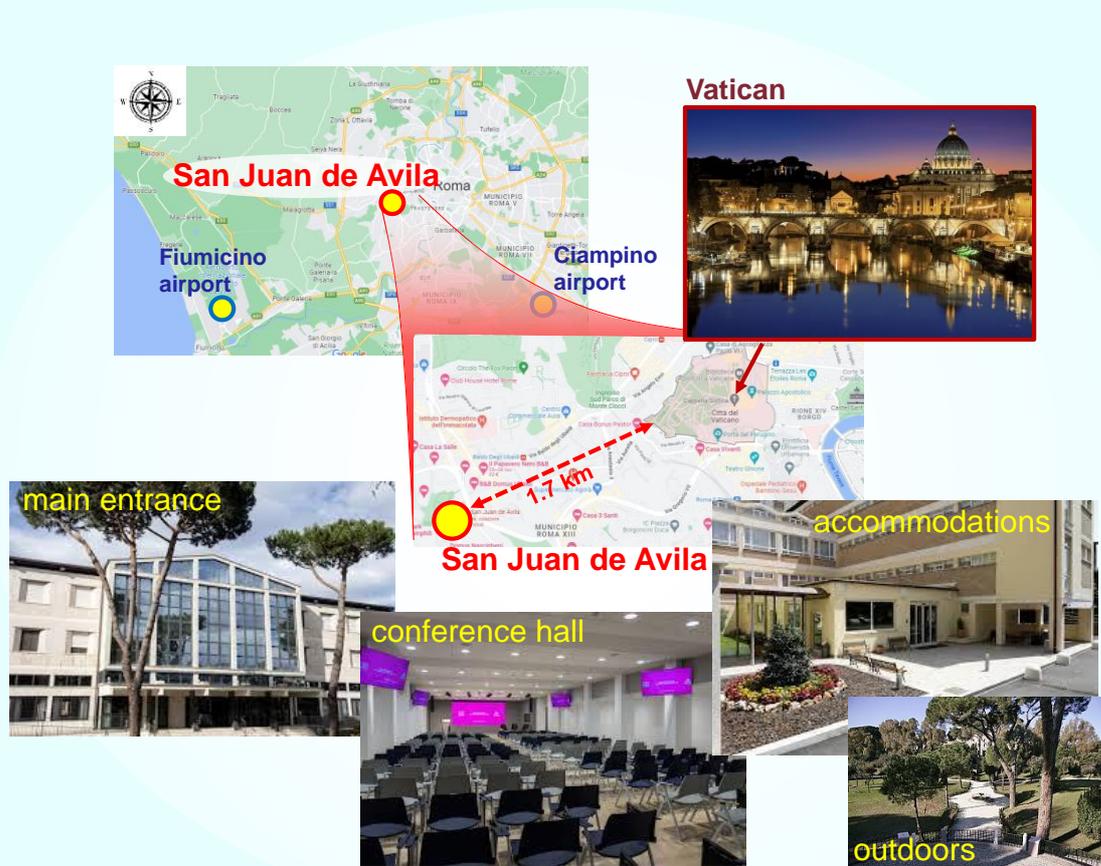


Venue: Casa San Juan de Avila
Via Pietro de Francisci, 00165, Roma (Italy)

The course will be held at Casa San Juan de Avila, that has a privileged location in the heart of Rome, well connected by both private and public transport. It is situated less than 200 m away from the stop of buses reaching Vatican City and the center of Rome, and 700 m away from the underground stop Cornelia (line A).

The House is surrounded by a green park that borders the one of Villa Carpegna, a historic place in Rome, and is 5 min walking from Villa Doria Pamphilj (one of the largest parks in Rome).

Website: <https://www.casasanjuandeavila.org>.



Registration and fees

Registration to the school is mandatory through this [form](#). Registrations will be accepted subject to availability (maximum number of attendees = 100).

Casa San Juan de Avila has a limited number of accommodations, which will be booked subject to availability (80 accommodations available).

The payment of the fees can be made after acceptance of registration and however by 30 December 2022 through bank transfer (bank coordinates will be communicated after acceptance).

Registration fees

payment	school attendance	board and lodging (4 days)
by Nov 30, 2022	250 euros	360 euros
Dec 1 to 30, 2022	250 euros	400 euros