The course will be held in Pavia (Italy), a charming medium sized town situated 40 km south of Milan, renowned also internationally for one of the world oldest academic institutions. In fact, the University of Pavia was founded in 1361 and until the 20th century was the only university in the region of Lombardy. Today it hosts more than 23,000 students including several from foreign countries.

The course venue is Collegio Ghislieri, a historical university residence of excellence located in downtown Pavia founded in 1567 by Pope Pio V. The lectures of the course will be held in the Goldonian auditorium. Coffee breaks will be organized in the Saint Pio lounge.

The registration fee is 450,00 € for PhD students and postdocs and 650,00 € for researchers of regular staff of universities and research centers. A limited number of applications at the special rate of € 300 will be accepted from PhD students and researchers from the University of Pavia. Due to Covid-19 restrictions, the Goldonian auditorium can host up to a maximum of 50 participants. Reservations will be made on a first-come, first-served basis. Applicants can register at the course via the website http://mech-waves-course.unipv.it/registration/ no later than July 30, 2022.

ACCOMMODATION

The town of Pavia has a number of accommodation facilities to host the participants. A list of hotels and B&B in Pavia is available at the link http://mech-waves-course.unipv.it/accommodation/. Please note that several conferences and summer schools are scheduled in town in the month of September, therefore the participants interested in attending the course are strongly encouraged to book the accommodation in advance.

A limited number of PhD students and post-docs who are not supported by their own academic or research institutions can apply to student residences in Pavia which offer lodging at a particularly convenient rate. Requests should be addressed to the Secretariat of the Department of Civil and Architectural Engineering of the University of Pavia (see below the contact details) by July 15, 2022 together with the applicant’s CV and a letter of support signed by the student’s supervisor confirming that the institution cannot provide funding.

For further information please contact:
Department of Civil and Architectural Engineering
University of Pavia
Via A. Ferrata, 3
27100 Pavia (Italy)

Phone +39 0382 985463
E-mail: mech-waves-course@unipv.it
Web: http://mech-waves-course.unipv.it/
The exploitation of the properties of mechanical waves propagating in the interior and along the boundary of a deformable solid is the basis of fundamental achievements in science and engineering. To mention a few, in seismology we currently know about the interior structure of the Earth is to a large extent drawn from the interpretation of earthquake recordings. In geophysics, mechanical waves are used to explore the depths of the Earth’s crust in search of oil and gas reservoirs or large geological cavities for CO₂ storage. In seismic engineering, earthquake disasters are often caused by the amplification of ground motion which is a typical wave-related phenomenon. In civil, mechanical and aerospace engineering, ultrasonic techniques are used as non-invasive diagnostic tools for detecting defects of structural components and they are based on exploiting the properties of high-frequency surface and bulk mechanical waves. Lastly, when a high-speed train exceeds a critical velocity, shock mechanical waves are generated and they are conceptually similar to the ones sparked by a supersonic aircraft with all the implications for the vibrational impact induced in the surroundings of the railway line.

Despite the diversity of the aforementioned examples, also for the characteristic wavelengths, the underlying physics of the phenomenon involved is the same and linked to various properties of mechanical waves. The mathematical modeling may be different owing to a variety of constitutive assumptions that may be employed to simulate material behaviour. Examples include one-constituent elasticity, viscoelasticity, and multi-component poroelasticity. However, steel, concrete, aluminum and even soils or rocks are still conventional deformable materials. Over the past thirty years or so, a new class of engineered metamaterials as they are purposely designed to have properties that are not found in ordinary materials. For instance, seismic metamaterials can inhibit or manipulate the propagation of seismic waves over certain frequency bands. They are made of ordered assemblies of multiple elements constituting composite periodic structures. Wave phenomena such as the acoustic rainbow trapping, are artificially created in elastic metamaterials to protect constructions from the earthquake ground motion. The recent development of these innovative classes of materials introduces a new paradigm in engineering and science for the design of smart materials and structures.

The course aims at covering the above-mentioned variety of topics by treating them in a unified framework. It is trans-disciplinary and delivered by top specialists in their respective areas of research. The course is addressed to PhD students and scholars working in different yet interacting research fields of dynamics of continua including but not limited to geophysics, seismology, structural mechanics, geotechnical engineering, material science and applied mathematics.

LECTURERS

- B. Detmann – University of Duisburg-Essen, Germany
  6 lectures on: Poroelastic theories for wave propagation in fluid-saturated and partially saturated porous media.
- S. Guenneau – CNRS & Imperial College London, United Kingdom
  6 lectures on: Metamaterial applications on the shielding properties of meta-materials in engineering.
- E. Kausel – Massachusetts Institute of Technology, Boston, USA
  6 lectures on: Wave propagation in elastic media and layered half-spaces. Vibrations induced by moving loads with applications to fast and super-fast trains.
- C.G. Lai University of Pavia, Italy
  6 lectures on: Classification of wave motion. Waves in elastic waveguides. Wave motion in linear dissipative continua.
- A. Marzani – University of Bologna, Italy
  6 lectures on: Wave propagation in phononic and resonant mechanical metamaterials and metasurfaces.
- H. Steeb – University of Stuttgart, Germany
  6 lectures on: Acoustic waves in poroelastic media: The role of heterogeneities across scales.

PRELIMINARY SUGGESTED READING

**Books**


Krylov, V.V. (2019). Ground Vibrations from High-Speed Railways: Prediction and Migration. Publisher: Institution of Civil Engineers (ICE), pp. 367.


**Articles**


