

**Course offered for the PhD program
in Civil, Chemical and Environmental Engineering
Curriculum in Structural and Geotechnical Engineering, Mechanics and Materials a.a. 2023
(XXXIX ciclo)**

(course is open for participation of students from other PhD cycles or programs)

1. Title

Mathematical techniques to solving problems in mechanics: Integral transforms and Wiener-Hopf method.

2. Course Description

- Mathematical modeling in engineering. Reducing stationary and non-stationary problems (e.g. electricity, conductivity, filtration) to partial differential equations. Multi-physical coupled and uncoupled problems. Partial differential equations of the second order describing the corresponding problems. Elliptical, hyperbolic and parabolic equations. Methods of solutions. Elastic and inelastic deformation of solids. Isotropy and anisotropy. 3-D and 2-D problems.
- Integral transforms as a tool to solve problems in engineering. Laplace and Fourier integral transforms. Examples: traditional problems of mathematical physics.
- Introduction to computer algebra codes (Wolfram Mathematica, Maple, ...).
- Using Integral transforms for solving elastic problems. Deformation of elastic isotropic strip and half-plane.
- Some auxiliary information on theory of functions of complex variables. Formulation of Wiener-Hopf problems.
- Solution of selected problems in elasticity and fracture mechanics through the solution of Wiener-Hopf equations:
 - A semi-infinite crack in a plane. Stress concentration near the crack tip.
 - Cracks along the boundary of two materials (interface cracks). Stress concentration near the tip of interface cracks.
- Lab work: applications using Wolfram Mathematica

3. Course Organization

The course is provided via theoretical lectures and some practical work. Classes will be in person. Online classes may be provided upon request.

4. Teacher

Konstantin B. Ustinov, Russian Academy of Sciences

5. Duration and credits

10 hours

6. Activation mode and teaching period

The course will be held during the last week of May 2023. Preliminary dates: May 24-26, May 29.
Application: email message to Prof. Roberta Massabò (roberta.massabo@unige.it)

7. Deadline for registration

May 20, 2023

8. Final exam

The final exam is an oral discussion on the content of the course in the beginning of June 2023.