DIP. DI INGEGNERIA INDUSTRIALE
DAST (Doctorate in Aerospace Science and Technology)

Perturbation methods in mechanics

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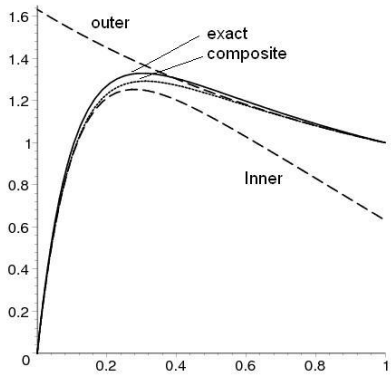

Course description

The course is designed to provide the students familiarity with perturbation methods, with special focus on how these methods provide useful insight in mathematical problems encountered in physics and engineering. The solution of ordinary differential equations with one small/large parameter will be analyzed, both within the framework of regular- or singular-perturbation theory, with special attention on boundary-layer theory and multiple-scale analyses. A final assignment will be given to assess the students' learning outcomes.

Course agenda

The course will be held in presence at Dipartimento di Ingegneria Industriale, Via Montaspro 97, Forli', and online via Teams on the following dates:

- September 8th 14:30-16:30
- September 10th 10-12
- September 15th 10-12
- September 17th 10-12
- September 22th 10-12
- September 24th 10-12

Learning outcomes

Once the course will be completed, the student should be able to:

- Explain basic concepts of perturbation techniques, such as order relationships, asymptotic sequences, asymptotic expansions and convergence issues.
- Propose a solution method for regular perturbation problems.
- Explain the difference between a regular and a singular perturbation problem.
- Analyze a singular problem by means of a balancing method and boundary-layer theory.

- Determine inner and outer solutions for singular perturbation problems by means of boundary-layer theory and the composite form.
- Perform a multiple-scale analysis on linear and non-linear problems.

Eligibility

Basic knowledge of ordinary differential equations, Mechanics and Python.