Course offered for the PhD program in Civil, Chemical and Environmental Engineering a.a. 2021/2022
Curriculum in Fluid Dynamics and Environmental Engineering
Curriculum in Structural and Geotechnical Engineering, Mechanics and Materials
Curriculum in Wind Science and Engineering

(possibility of participation for students in other PhD cycles or other PhD courses)

1. Title

Perturbation Methods 2

2. Course description

In smooth continuity with the introductory counterpart (Perturbation Methods 1), the course deals with methodological and applicative aspects concerned with the employment of asymptotic techniques. The perturbation-based solutions of algebraic and differential problems are presented by means of traditional and advanced tools (such as fractional power series or multiparameter expansions). Different mathematical issues recurring in the fields of Mathematical Engineering and Mechanics are faced, including eigenproblems, dimension reductions, static/dynamic bifurcations, self-excited and forced oscillations and parametrically excited systems.

3. Course Organization

The course consists of lectures and exercises. Softwares for symbolic computation are introduced.

4. Teachers

Marco Lepidi, Giuseppe Piccardo

5. Duration and credits

The course consists of 10 hours of lessons (2 credits)

6. Activation mode and teaching period

The course is scheduled every two years, free of charge. The course will be held in the week 14th-18th February 2022, and scheduled in series with Perturbation Methods 1. The minimum number of participants to activate the course is 5.

7. Deadline for registration

The deadline for applications is 11th February 2022. Confirmation can be sent by e-mail to Marco Lepidi (Marco.Lepidi@unige.it) or Giuseppe Piccardo (Giuseppe.Piccardo@unige.it).

8. Final exam

Written examination (solution of one or more simple problems) at the end of the course

9. References

- Bacigalupo A, Lepidi M (2016), High-frequency parametric approximation of the Floquet-Bloch spectrum for anti-tetrachiral materials. Int. J. Solids and Structures 97-98, 2016 pp.575-592.
- Lepidi, M. (2013), Multi-parameter perturbation methods for the eigensolution sensitivity analysis of nearly-resonant non-defective multi-degree-of-freedom systems. J. Sound and Vibration, 332(4), 1011-1032.
- Luongo A. (1995), Eigensolutions of perturbed nearly-defective matrices. J. Sound and Vibration, 185(3), 377-395.
- Luongo A., Paolone A. (1997), Perturbation methods for bifurcation analysis from multiple nonresonant complex eigenvalues. Nonlinear Dynamics, 14(3), 193-210.
- Luongo, A. (2017) On the use of the multiple scale method in solving 'difficult' bifurcation problems. Mathematics and Mechanics of Solids 22(5) pp.988-1004.
- Nayfeh A.H. (1993), Introduction to Perturbation Techniques. John Wiley & Sons
- Nayfeh, A.H., Mook, D.T. (2008). Nonlinear oscillations. John Wiley & Sons
- Seyranian A, Mailybaev A. (2003), Multiparameter stability theory with mechanical applications. World Scientific.