



UNIVERSITY OF GENOA

## PhD Program in Civil, Chemical and Environmental Engineering

### Course offered for the PhD program in Civil, Chemical and Environmental Engineering A.Y. 2016/2017 (XXXII, XXXI and XXX cycles)

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

#### **1. Title**

Fluid-solid interactions

#### **2. Course Description**

The aim of the course is to give the students the ability to address the main issues of fluid-solid interactions, in a large variety of applications (civil, marine, aerospace, biomechanical, ...). The course is based on the on-line MOOC "Fundamentals of fluid-solid interactions" which the students will use as support.

#### ***Prerequisite***

- Fundamentals of Fluid Mechanics and of Structural Dynamics
- Before the course, the student should register (free) on Coursera for the on-line course, and browse through all the course (about 6 hours of videos). Lectures will be based on the material of the Mooc, but a preliminary knowledge of the content is needed for a better benefit.

#### **3. Course Organization**

- **Day 1 (September 19<sup>th</sup>, 2017)**
  - **Lecture 1:** Fundamentals
  - **Tutorial 1:** Applied dimensional analysis in FSI
  - **Lecture 2:** Coupling with a still fluid
  - **Tutorial 2:** Added mass on a submerged cable. Sloshing in a truck
- **Day 2 (September 20<sup>th</sup>, 2017)**
  - **Lecture 3:** Coupling with a fast flow
  - **Tutorial 3:** Instability of a pump rotor. Panel flutter
  - **Lecture 4:** Coupling with any flow
  - **Tutorial 4:** Galloping of a square building. Energy harvesting by VIV

#### **4. Teacher**

[Emmanuel de Langre](#)

Professor, École Polytechnique, Palaiseau, France

Editor of the [Journal of Fluids and Structures](#)

#### **5. Duration and credits**

8 hours (3 credits)



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### **6. Activation mode and teaching period**

The course will be held in two days, as specified above. The minimum number of participants to activate the course is 5.

### **7. Deadline for registration**

The deadline for applications is September 1<sup>st</sup>, 2017; please, send an e-mail confirmation to Giuseppe Piccardo ([giuseppe.piccardo@unige.it](mailto:giuseppe.piccardo@unige.it)).

### **8. Final exam**

Written examination (solution to simple problems; one hour at the end of second day).

### **9. Recommended References**

"Fundamentals of fluid-solid interactions". Mooc on Courser, [www.coursera.org/learn/fluid-solid-interaction](http://www.coursera.org/learn/fluid-solid-interaction)

Païdoussis, M. P., Price, S. J., de Langre, E. (2010). Fluid-structure interactions: Cross-flow-induced instabilities. Cambridge University Press

Blevins, R. D. (1990). Flow-induced vibration. Van Nostrand Reinhold

Axisa, F. Antunes, J. (2006). Modelling of Mechanical Systems: Fluid-Structure Interaction (Vol. 3). Butterworth-Heinemann

Dowell, E. (2014). A modern course in aeroelasticity (Vol. 217). Springer.