TRA270, 7.5 credits

Engineering Fluid-Structure Interaction: Technologies and Practices

Tracks is a new concept within Chalmers' educational offering of elective, flexible and interdisciplinary courses in different current thematic areas. More details about Tracks are referred to in the link.

This course is a cross-disciplinary project and is not included in any educational programmes or departments but between existing educations. **Students from all programmes are welcome.**

Why fluid-structure interaction (FSI)?

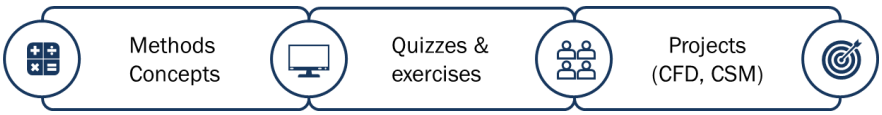
Interaction between fluids and structures is widely found in industry (e.g., marine, aerospace, automotive, renewable energy, nuclear power, construction, sports, biomedicine, and agriculture). For example, ship hulls, offshore architectures, sailing, aircraft frames and wings, turbomachinery blades, rockets, unmanned vehicles, parachutes, airbags, wind turbines, nuclear assemblies, blood vessels, arterial bool, heart valves, whiplash, tall buildings, high bridges, agriculture plants and watering, music instrument timbre, and audio fidelity. In ocean engineering, systems are usually subjected to strongly coupled interactions between flows and structure deformations/vibrations. Although a huge number of engineering problems have been identified, it is difficult to analyze them due to the inherited multiphysics physics, which integrates fluid dynamics, solid mechanics, and acoustics. Engineers and scientists need in-depth knowledge to down select methods and develop models for various scenarios in the practice.

Expected learning outcomes

- Understand methods and techniques for classical FSI such as aero/hydro elasticity, and aero-vibro acoustics, etc.
- Be capable of identifying and analyzing dominant mechanisms in various engineering scenarios.
- Be capable of deriving and explaining the governing equations for the coupled flow and structure motion/deformation.
- Understand FSI coupled algorithms and numeral methods.
- Grasp how to use commercial software, which is popular in the industry, to simulate FSI problems.

Course framework

The course consists of three sections on methods, exercises, and an extensive project. The first two sections are devoted to understanding the basics. In total, 6 lectures are scheduled once per week. After the lectures, a 3-week project targeting industrial applications is arranged with the options: marine techniques, offshore architectures, aerospace, automotive, biomechanics, sailing sports. A student can pick up one of the options that best fits his/her educational background. The project work will be documented in the form of a written report and presented at the end. More details about the course can be found at the link.



Prerequisites

Fundamental fluid and solid mechanics are beneficial but not necessary, since basic FSI-related theories and skills will be introduced in the course. English is used.

Study period

LP2, 2023/24

Application deadline

20 October, 2021

Teachers

Hua-Dong Yao, Jesper Oppelstrup (KTH),
Lukas Schickhofer (Siemens)
Department of Mechanics and Maritime Sciences

How to apply?

Please send your CV and course transcripts (merged in one file) to huadong.yao@chalmers.se. At the beginning of the CV, please outline your current programme and which specific topic/problem in FSI you are interested in.

Tracks Theme: Sustainable Transport