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| Course unit English denomination | Sustainable solutions for ports |
| Teacher in charge (if defined) | Luca Martinelli |
| Teaching Hours | 24 |
| Number of ECTS credits allocated | 4 |
| Course period | December |
| Course delivery method | ☒ In presence<br>☐ Remotely<br>☐ Blended |
| Language of instruction | English |
| Mandatory attendance | ☒ Yes (70 % minimum of presence)<br>☐ No |
| Course unit contents | The course aims at describing possible sustainable solutions for port layouts, with specific reference to floating breakwaters, possibly integrated to wave energy converters. The tools to predict the motion of free and moored floating structures, especially where the wave force is of primary importance, will be discussed. Prerequisites are a knowledge of the basics of fluid mechanics, rigid body dynamics, Fourier transforms, programming languages. Topics that will be covered: Motivations and Objectives. Definition of a sea wave. Sinusoidal waves and Euler's formula. Potential flow. Airy's theory. Non-linear approaches. Progressive and evanescent waves. Dispersion relationship. Waves in deep, intermediate, and shallow water. Irregular waves. Characterization in the time domain. Irregular waves. Characterization in the frequency domain. Floating breakwaters (types and mooring systems). Performance (Ruol formula) and typical applications. Integration with wave energy converters. Diffraction and radiation problems. Hydraulic impedance of a floating body. Classwork (numerical examples): Wave characterization in the time and frequency domain (Hrms, Hs, Hmo, Tm, Tp, Tm-1, etc.). Response of a floating breakwater moored with piles (Response Amplitude Operator). |
| Learning goals | Knowledge to characterise irregular waves in the time and in the frequency domain, and to analyse the dynamic of a floating body under such wave load. Ability to apply the acquired knowledge to analyse a real floating structure. Ability to critically examine and compare the behaviour of alternative floating body shapes subject to different mooring systems. |
| Teaching methods | Frontal lessons with the aid of PowerPoint and animations. Classwork in Matlab with application to a case study. |
| Course on transversal, interdisciplinary, transdisciplinary skills | ☐ Yes<br>☒ No |
| Available for PhD students from other courses | ☒ Yes<br>☐ No |

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| Prerequisites (not mandatory) | Prerequisites are a knowledge of the basics of fluid mechanics, rigid body dynamics, programming languages, and possibly Fourier transforms. |
| Examination methods (in applicable) | Presentation and discussion of the project homework assigned during the course |
| Suggested readings | Notes given in class |
| Additional information | None |