Seminar on *Modelling of Wave Propagation and Wave-Body Interaction*

Location: Room Landsort, Building SAGA, Campus Lindholmen, Gothenburg
Time: December 8, 9:00 - 12:30

09:00 Welcome and coffee

09:30-9:45 Presentation of the MIDWEST project
Prof. Mario Ricchiuto, INRIA, Bordeaux

09:50-10:30 *Modelling floating structures using a compressible-incompressible approach*
Prof. David Lannes, Uni. of Bordeaux

10:30-11:00 *Toward a unified spectral element Boussinesq model for point absorbers*
PhD student Umberto Bosi, INRIA, Bordeaux

11:15-11:45 *A spectral element fully nonlinear potential flow model for wave propagation and wave-structure interactions*
Prof. Allan P. Engsig-Karup, DTU

11:45-12:15 *CFD modelling of moored WECs*
Dr. Claes Eskilsson, Chalmers

12:15-12:30 Closing remarks

Organized by

MIDWEST - an OceanEra-Net project
https://project.inria.fr/midwest/

Maritime Cluster of Western Sweden
http://maritimaklustret.se

Modelling floating structures using a compressible-incompressible approach
Prof. David Lannes, Dep. of Mathematics, University of Bordeaux

Using vertically averaged models for the hydrodynamic equations (full Euler equations, nonlinear shallow water or Boussinesq equations), the pressure exerted on the immersed part of a floating body can be expressed as a Lagrange multiplier associated to the constraint on the water elevation under the body. The resulting model is of mixed compressible (in the free surface region) and incompressible (under the body) structure. We will show how to handle this coupling. An analysis of the pressure term allows moreover an efficient formulation of the equations for the solid motion. This approach can also be implemented at the numerical level and several simulations will be shown.

Toward a unified spectral element Boussinesq model for point absorbers
PhD student Umberto Bosi, Team Cardamom, INRIA

Motion response and power production of floating wave energy converters (WECs) are typically modelled using radiation/diffraction models. These models are fast but disregard nonlinear and viscous effects. In this talk we discuss a medium-fidelity model for nonlinear motion response of WECs based on Boussinesq-type equations. Boussinesq-type models are expressed in horizontal dimensions only, resulting in computationally efficient models. The wave-body coupling is achieved using the unified Boussinesq approach of Jiang (2001). We will discuss the formulation of Jiang, the finite element discretizations for Boussinesq-type models for WEC hydrodynamics, the coupling methodology as applied using a nodal spectral element method and present some test cases dealing with a heaving box.

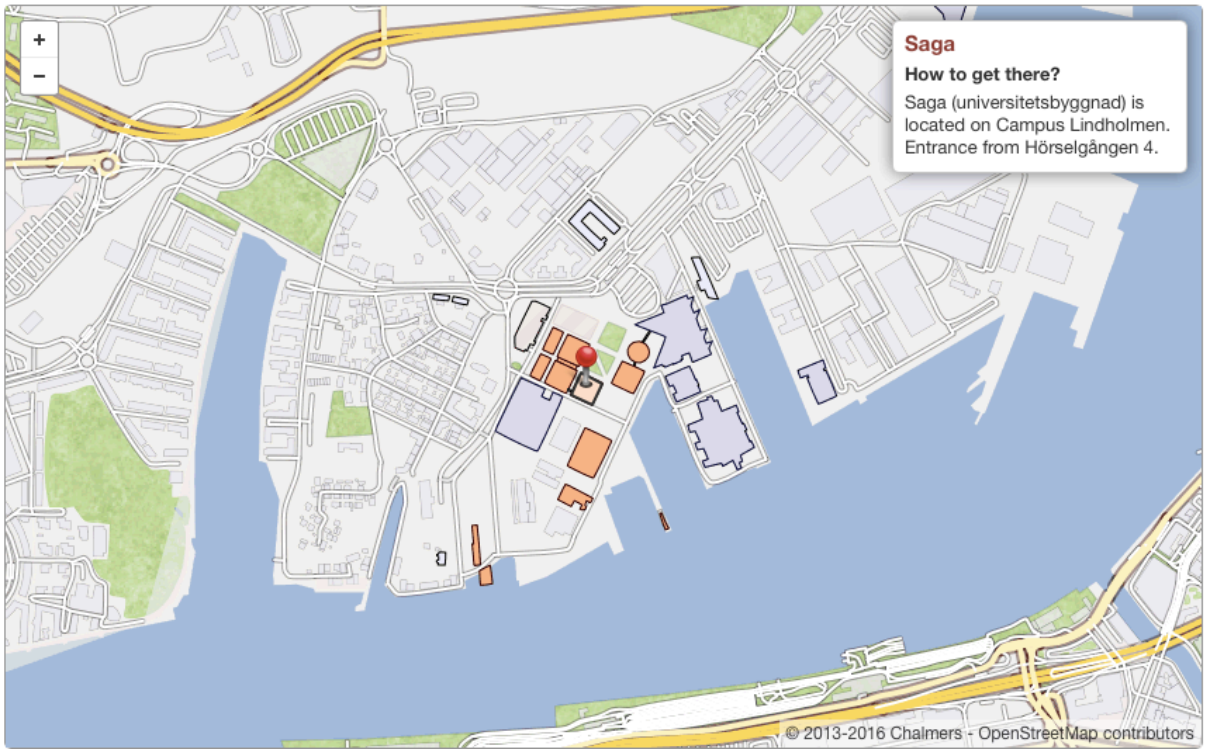
A spectral element fully nonlinear potential flow model for wave propagation and wave-structure interactions
Prof. Allan P. Engsig-Karup, Department of Applied Mathematics and Computer Science/Center for Energy Resources Engineering, Technical University of Denmark

We present a stabilised and efficient high-order nodal spectral element method based on either sigma-tranformation (for pure wave propagation) or the Mixed Eulerian Lagrangian (MEL) method (for wave-body interactions) simulation of fully nonlinear water waves in the time domain. The surface formulation based on the Zakharov form contains quartic nonlinear terms that require careful treatment due to the possibility of strong aliasing effects. We demonstrate how to stabilise this nonlinear scheme using an efficient combination of (i) global L2 -projection without quadrature errors, (ii) mild nonlinear spectral filtering and (iii) re-meshing. In the MEL formulation arbitrary body shapes are handled by using unstructured high-order curvilinear iso-parametric quadrilateral/triangular elements. The use of high-order elements is shown to lead to a substantial reduction in computing times by reducing the total degrees of freedom in the volumetric mesh compared to using conventional low-order finite element methods.

CFD modelling of moored WECs
Dr. Claes Eskilsson, Dep. of Shipping and Marine Technology, Chalmers University of Technology

CFD modelling is getting more and more popular for modelling the motion response of wave energy converters (WECs), especially for overtopping devices and point absorbers in resonance were nonlinear effects clearly are significant. In this talk we will discuss pros and cons of using CFD compared to more standard diffraction/radiation methods, talk about present problems and shortcomings as well as possible treatments thereof.

How to get to SAGA Building:



For detailed description see

http://www.chalmers.se/en/departments/smt/contact/Pages/Find-your-way-.aspx