A fictitious domain approach to fluid-solid solid interaction including free surface flows

B. Ducassou *, S. Abadie *, M. Cruchaga †, J. Nunez †

* Laboratoire SIAME
1 allée du parc Montaury
64600 Anglet, France
benoit.ducassou@univ-pau.fr
stephane.abadie@univ-pau.fr

† Universidad de Santaigo de Chile
Departamento de Ingeniería Mecánica,
Av Lib Bdo. O'Higgins 3363
Santiago de Chile, Chile
marcela.cruchaga@usach.cl
jonathan.nuneza@usach.cl

ABSTRACT

This work presents a new numerical method for a fluid-structure interaction based on a fictitious domain approach[1]. To this end, the Navier-Stokes equations are solved in the whole domain where the free surface and the body contour are captured using a VOF method[2].
In this framework, a infinite dynamic viscosity is adopted to mimic the solid. To describe the rigid body motion, a single degree of freedom model, able to represent translation or rotation, is embedded in the code. In such a model, the body forces are represented by a spring (proportional to the displacement) and a shock absorption force (proportional to the speed of movement) volumetric forces in the solid region. The proposed strategy is tested in a sloshing damping system and a wave energy converter system. The numerical results are compared with experimental data reported in the literature [3] and with data obtained within the present study.

ACKNOWLEDGEMENT

The authors thanks the support given by CONICYT-ECOS Project C12E01 and Fondecyt 1130278.

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