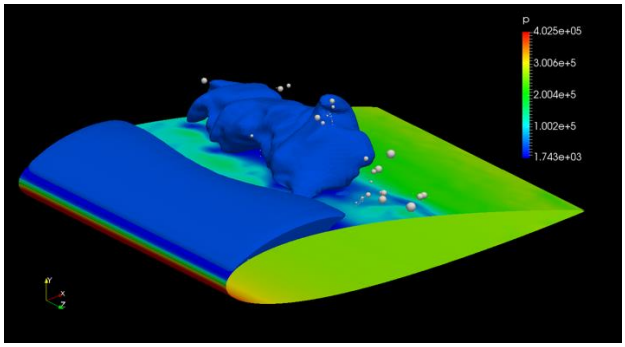
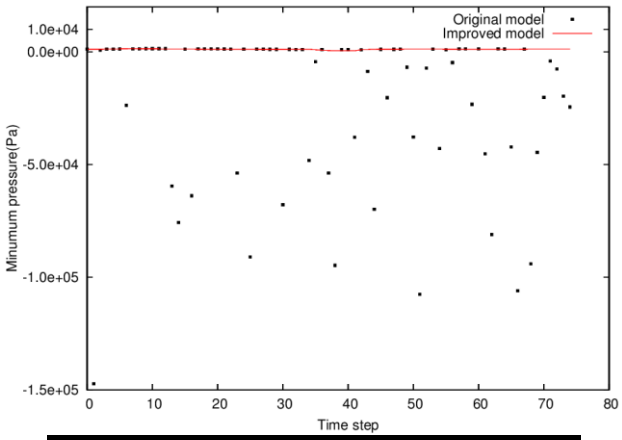
Summary of Deliverable D3.3: LES methodology with a sub-grid scale model

provided by ESR 8, Mr Ebrahim Ghahramani, under the guidance of Prof. Rickard Bensow, Chalmers University of Technology, March 2018



Eulerian cavities and Lagrangian bubbles over hydrofoil



Minimum pressure after Eulerian-Lagrangian transition

Incompressible transport equation models are considered a practical option for simulation of large scale cavitating flows with reasonable computational expenses. However they usually give a limited representation of the small scale vapour structures. To improve the resolution of all scales of cavity structures in these models at a moderate additional computational cost, a possible approach is to develop a hybrid Eulerian-Lagrangian solver in which the larger cavities are considered in the Eulerian framework and the small (sub-grid) structures are tracked as Lagrangian bubbles. A critical step in developing such hybrid models is the transition of the cavity structures from an Eulerian to a Lagrangian framework, where inappropriate transformation of structure between the frameworks may lead to significant numerical pulses and negative pressures. In this paper, such a multi-scale model for numerical simulation of cavitating flows is described and some encountered numerical issues for Eulerian-Lagrangian transition are presented. To address these issues, a new improved formulation is developed, and simulation results are presented that shows the issues are overcome in the new model.