Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Stochastic field modeling of cavitating flows in OpenFOAM

MICHAEL RANFT, Institute for nuclear and energy technology, Karlsruhe Institute of Technology, Germany, ANDREAS G. CLASS, Areva nuclear professional school, Karlsruhe Institute of Technology, Germany — In [1] analysis is presented for a fluidic diode with low/high pressure drop in forward/reverse flow direction. Accurate description of cavitation is needed due to the dominant effect of vapor bubbles on sound speed. The stochastic field method developed in [1] represents the statistics of growing cavitation bubbles by a set of stochastic fields of vapor fraction which evolve according to the Rayleigh-Plesset equation and local instantaneous LES flow conditions. Cavitation may originate from nucleation sites in the core of turbulent vortices. In this work a RANS model is used instead of LES. Local turbulent pressure fluctuations are recovered based on kinetic energy $k$ of turbulence and its Dissipation $\varepsilon$. In the Rayleigh-Plesset equation these fluctuations are represented by a Wiener process which is superimposed on the mean pressure. Usually a set of stochastic fields is introduced for each stochastic variable. Here two independent Wiener processes, both acting on the vapor-fraction stochastic fields, drive the evolution of vapor bubble growth, so that a single set of stochastic fields can be maintained. The proposed methodology is implemented in OpenFOAM and applied to verification cases including the fluidic diode.


$^1$Funded by ANPS.