Fachbereich 4
Produktionstechnik
Maschinenbau &
Verfahrenstechnik

CENTER OF
APPLIED SPACE TECHNOLOGY
AND MICROGRAVITY

ZARM

Fluids and Space Engineering Seminar

Date: Wednesday, October 24, 2018 at 13:00
Location: ZARM, Room 1730

DNS simulations of two phase pipe flow
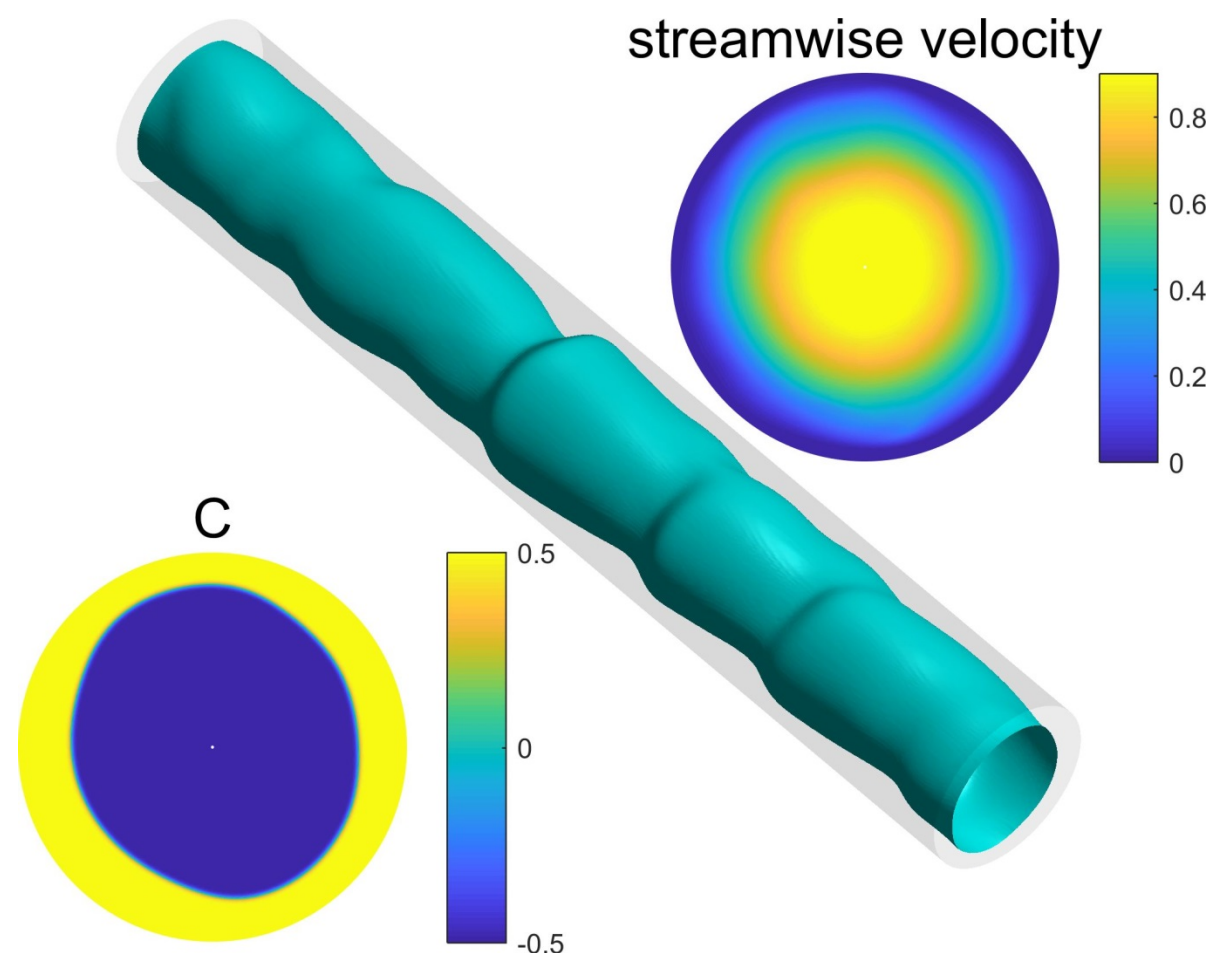
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Figure 1: Fluid interface of CAF. Phase field variable and streamwise velocity at cross-section. Re = 6000

Multiphase flows are encountered in many fields, including flow transport, environmental and chemical engineering, micro-fluidics or combustion. Numerous methods with different properties and applications have been developed for the simulation of two phase flows. Here we will focus on the Cahn-Hillard-Navier-Stokes (CHNS) method, a diffuse-interface method with a solid thermodynamic background. It will be shown how, with the right selection of the numerical parameters governing the interface thickness and mobility, the CHNS method is able to approach the sharp interface limit in two-phase flow simulations. This will be demonstrated by the simulation of the core-annular flow (CAF) regime in pipe flow, a configuration of great interest in the lubricated transport of viscous fluids. In the CAF arrangement, a highly viscous fluid flows through the center of the pipe, while a less viscous one occupying the region close to the pipe wall. The study of the laminar CAF regime, from the linear stability analysis to the non-linear saturation will prove the suitability of the CHNS method to obtain reliable, quantitative results in multiphase flows simulations. Following, the potential of CHNS will be showcased by presenting a direct numerical simulation of the transition of turbulence in core-annular flows.