"Multiscale Analysis, Modelling and Simulation"
Top Global University Project, Waseda University
Special Seminar

Some results on phase-field and Korteweg-type models for the time-dependent flow of compressible two-phase fluids

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Abstract:
Prompted by work of Slemrod, Dunn and Serrin, Truskinovsky, Blesgen, Truskinovsky and Lowengrub, and Benzoni-Gavage and collaborators, so-called Navier-Stokes-Allen-Cahn (NSAC), Navier-Stokes-Cahn-Hilliard (NSCH), and Navier-Stokes-Korteweg (NSK) equations have been used in recent literature to model the dynamics of two-phase fluids. We first introduce these equations and demonstrate how the phase-field models NSAC and NSCH both cover various classes of fluids, distinguished according to whether none, one, or both of the phases are compressible, and according to the nature of their co-existence. The latter is captured not only by the mixing energy, but also by a 'mixing rule'—a constitutive law that characterizes the type of the mixing. Next, we show that in the case of two immiscible incompressible phases of different temperature-independent specific volumes, NSAC reduces literally to NSK; an analogous fact is shown for NSCH, which under the same assumption reduces to a new non-local version of NSK. (So far joint work with M. Kotschote.) A third part of the exposition summarizes existence results M. Kotschote has obtained over years on NSK as well as on NSAC and NSCH. Turning to phase boundaries in NSK, NSAC, and NSCH, we next recapitulate Slemrod's concept of the 'viscocapillary profile' of a phase boundary in NSK and Benzoni-Gavage's results on the stability of phase boundaries with such profiles. In a fifth part, we show that analogous traveling waves exist in NSAC and NSCH. If time permits, we also discuss recent results of M. Kotschote on the spectral stability of some of these diffuse phase boundaries.

Time:

Monday, 05 March 2018 14:00-16:00
Wednesday, 07 March 2018 14:00-16:00

Place:

Room 311, 51 Building, Nishi-Waseda campus, Waseda University

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