Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

A numerical model for liquid-vapor flows with arbitrary heat and mass transfer relaxation times and general equation of state[1] MARICA PELANTI, ENSTA Paris, MARCO DE LORENZO, Compressor Controls Corporation, PHILIPPE LAFON, EDF — We describe liquid-vapor flows by a single-velocity six-equation two-phase compressible flow model with relaxation source terms accounting for volume, heat and mass transfer. The system of equations is numerically solved by a classical fractional step algorithm, where we alternate between the solution of the homogeneous hyperbolic portion of the model system via a HLLC-type finite volume scheme, and the solution of a sequence of systems of ordinary differential equations for the relaxation source terms driving the flow toward mechanical, thermal and chemical equilibrium. For an accurate description of the thermodynamical processes involved in transient liquid-vapor flow problems it is often important to be able to simulate both instantaneous and finite-rate relaxation processes. In this work we present new numerical relaxation procedures to integrate interphase transfer terms with two significant properties: the capability to describe heat and mass transfer processes of arbitrary relaxation time, and the applicability to a general equation of state. We show the effectiveness of the proposed computational model by presenting several numerical tests in one and two dimensions, including simulations of depressurization and blowdown experiments.

[1]This work was partially supported by the French Government Grant DGA N. 2018600071004707501.

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Date submitted: 24 Jul 2019 Electronic form version 1.4