Numerical Solution of Transonic Wet Steam Flow with Non-equilibrium Condensation

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Abstract

The contribution presents approach to modeling of 2D transonic steam flow with non-equilibrium phase change (condensation). First part of flow model is system of inviscid Euler equations for wet steam flow (mixture of dry steam and homogeneously dispersed water droplets). Second part describes liquid phase via transport equations for moments of droplets distribution function. Equation of state for steam is provided by recently developed so-called CFD formulation of IAPWS equations, which defines entropy function with independent variables density and internal energy. Therefore, thermodynamic quantities are calculated without any iteration. Nucleation rate is modeled following classical nucleation theory. For closure of the second part of the flow model, method of linearizing droplet growth law is applied. Due to different time scales of convection and condensation (stiff character of equations), symmetrical splitting method of Strang is applied for time integration.

Keywords: wet steam, condensation, nucleation, real equation of state.

References

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