

Experience on the implementation of SPH in nonequilibrium problems for micro-fluid

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ABSTRACT

The use of equilibrium thermodynamics has become an indispensable tool for simulating of problems in engineering and science [1], [2]. Moreover, the relation with the statistical mechanics was established, so many useful results based on further description microscopic are available [3], [4]. However, a wide variety of interesting phenomena as complex fluid rheology and relaxation processes, occurring outside of the equilibrium processes [5], [6].

So basically these processes have to deal situations of non-equilibrium thermodynamics, for which there is not generally accepted theory at the time. The method "General Equation for the nonequilibrium Reversible-Irreversible Coupling" (GENERIC) usually presents in a way to deal with nonlinear thermodynamics of non-equilibrium systems in a similar spirit as the theory of equilibrium which is well established [1], [2], [5].

This paper proposes to the formulation and application of classical hydrodynamics problem using GENERIC methodology [2], [7]–[9] and using the numerical method for particles Smoothed Particle Hydrodynamics (SPH) [4], [10], [11]. GENERIC shown being an adequate and elegant tool for simulating nonequilibrium problems, which can simulates situations of complex fluids, and in particular micro-fluidics case presents good results.

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