

The thesis aims to find a generalization of smoothed particle hydrodynamics to fluid models which are compatible with Hamiltonian formulation of physics. We develop an approach based on a particle discretization of Poisson brackets. The main advantage of this approach is easy verification of conservation laws, which are related to the degree of consistency of discrete derivatives. Firstly, we demonstrate our technique on a particle approximation of symmetric hyperbolic thermodynamically compatible equations, which allow for unified description of fluids, viscoelastic materials and solids. Secondly, we develop a novel particle approximation for superfluid helium-4.