

# Abstract

In this memoir, we prove the local-in-time well-posedness of thick spray equations in Sobolev spaces, for initial data satisfying a Penrose-type stability condition. This system is a coupling between particles described by a kinetic equation and a surrounding fluid governed by compressible Navier–Stokes equations. In the thick spray regime, the volume fraction of the dispersed phase is not negligible compared to that of the fluid. We identify a suitable stability condition bearing on the initial data that provides estimates without loss, ensuring that the system is well posed. This condition coincides with a Penrose condition appearing in earlier works on singular Vlasov equations. We also rely on crucial new estimates for averaging operators. Our approach allows us to treat many variants of the model, such as collisions in the kinetic equation, non-barotropic fluid or density-dependent drag force.

*Keywords.* thick sprays, singular coupling, Vlasov equation, Navier–Stokes equations, Penrose stability condition

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