Stabilised finite element discretisations applied to an operator splitting method of population balance equations

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In population balance equations, the distribution of the entities depends not only on space and time but also on their own properties referred to as internal coordinates. This results into a transient higher dimensional problem. First, an operator splitting method is applied to transform the original problem into two subproblems: a transient transport problem with pure advection and a time-dependent convection-diffusion problem. Then, both subproblems are discretised in time by a backward Euler time stepping scheme. A discontinuous Galerkin methods is applied for discretising the transport problem in the internal coordinate. For the convection-diffusion problem, stabilised finite element methods are used. In particular, the Streamline-Upwind Petrov-Galerkin (SUPG) method and the local projection stabilisation (LPS) method are investigated. We present error estimates for the two-step method and discuss the assumptions on the dependence of the stabilisation parameters on the time step length for both stabilisation methods. We also compare numerically the SUPG and the LPS method.

References:

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