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An adjoint-based framework for maximizing mixing in binary fluids MAXIMILIAN EGGL, PETER SCHMID, Imperial College London — Mixing in the inertial, but laminar parameter regime is a common application in a wide range of industries. Enhancing the efficiency of mixing processes thus has a fundamental effect on product quality, material homogeneity and, last but not least, production costs. In this project, we address mixing efficiency in the above mentioned regime (Reynolds number $Re = 1000$, Peclet number $Pe = 1000$) by developing and demonstrating an algorithm based on nonlinear adjoint looping that minimizes the variance of a passive scalar field which models our binary Newtonian fluids. The numerical method is based on the FLUSI code (Engels et al. 2016), a Fourier pseudo-spectral code, which we modified and augmented by scalar transport and adjoint equations. Mixing is accomplished by moving stirrers which are numerically modeled using a penalization approach. In our two-dimensional simulations we consider rotating circular and elliptic stirrers and extract optimal mixing strategies from the iterative scheme. The case of optimizing shape and rotational speed of the stirrers will be demonstrated.

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