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Near-optimal source placement in forced convection PIYUSH
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problem of optimal source placement, given the velocity field and sink distribution
in forced convection. We use the ratio of scalar concentration variance in presence of
advection compared to the purely diffusive case as our cost function. Using a semidef-
inite relaxation of the original optimization problem, we obtain near-optimal source
distributions for several classes of velocity fields in 2D. We compare the numerical
results with bounds obtained by analysis of space-time averaged advection-diffusion
equation. The dependence of optimal variance reduction on the Lagrangian prop-
erties of the velocity field and shape of sink distribution are made explicit in this
analysis. This work extends the earlier work in (Thiffeault, J. L., & Pavliotis, G.
A. (2008). Optimizing the source distribution in fluid mixing. Physica D: Nonlin-
ear Phenomena, 237(7), 918-929), and provides a systematic framework that can be
extended to more realistic models of forced and mixed convection.

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