Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

**Development of an optimal mixer: a conceptual study** OLEG GUBANOV, LUCA CORTELEZZI, McGill University — We define as an optimal mixer a mixing device able to deliver a uniformly optimal mixing performance over a wide range of operating and initial conditions. We consider the conceptual problem of designing an optimal mixer starting from a reference mixing device, the sine flow. We show that the time-periodic sine flow performs poorly and erratically over most operating and initial conditions. In steps we modify the design of the reference mixer to obtain a mixing device whose performance, over the entire operating range, is as good as or better than the best performance of the sine flow. First, we optimize the time-sequence of the stirring velocity fields. The resulting mixer performs substantially better than the sine flow, but it is still suboptimal because the actuating system cannot control all the states. Second, we equip the sine flow with a new actuating system that allows optimized shifts of the stirring velocity fields in the cross-flow direction. This new actuating system is able to control all states. The resulting mixer delivers a suboptimal performance only at low operating conditions due to the use of a time-periodic stirring protocol. Finally, we obtain an optimal mixer by coupling the time and shift optimizations. We show that the resulting optimal mixer is able to deliver a nearly uniform optimal performance, insensitive to the geometry of the initial conditions, over the entire operating range.

Luca Cortelezzi
McGill University

Date submitted: 07 Aug 2009 Electronic form version 1.4