Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

The effects of stochastic gravity modulation on fluid mixing V.K. SIDDAVARAM, G.M. HOMSY, Dept. Of Mech. Eng., UCSB — We study the effects of zero-mean stochastic gravity modulation on the mixing characteristics of two miscible fluids initially separated by a thin diffusion layer. Both correlated and uncorrelated gravity modulation are considered and the 2D time-dependent Boussinesq equations are solved numerically. The flow is characterized by a Grashof number, $Gr = \frac{\Delta\rho}{\bar{\rho}} g \frac{l_\nu^3}{\nu^2}$, based on the viscous length scale, $l_\nu = \sqrt{\nu/\omega}$, where ω is a frequency defined through the power spectrum; the Schmidt number, Sc; and geometric aspect ratios. We vary Gr, holding the other parameters constant, and study the evolution of the interface. For both correlated and uncorrelated jitter, the ensemble averages of realizations exhibit dispersive spreading of the interface at a rate which is amplified by Gr, and which is larger for correlated jitter. Individual realizations exhibit the formation of folds, which are more pronounced in the case of correlated jitter. Many of the phenomena occurring for deterministic jitter also occur in the stochastic case, but at a lower equivalent Gr. Accordingly, the rate of mixing for stochastic jitter is higher than that for deterministic harmonic jitter.

G. M. Homsy
Dept. Of Mech. Eng., UCSB

Date submitted: 28 Jul 2005 Electronic form version 1.4