Exchange flows in the low Reynolds number flow limit LAURENCE
RONGY, Harvard University, HOWARD STONE, Princeton University — We an-
alyze the viscous gravity current that occurs when two fluids with different densities
flow into each other in a two-dimensional channel. Assuming that the mixing be-
tween them and the surface tension at their interface are negligible, we study the
flow within the lubrication approximation. For the general case of two fluids with
different viscosities and in the presence of an imposed flow rate, the evolution of
the current can be described by a single nonlinear PDE. When the mean flow rate
is zero (closed channel) the model admits self-similar solutions for the thickness of
the gravity current and solutions are obtained for different viscosity ratios. We also
present numerical solutions for the gravity current in the cases of a non-zero imposed
flow rate (open channel).

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