Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

FEM calculations of drop breakup beyond the first singularity RONALD SURYO, Purdue University/Exxon Mobil Research, OSMAN BASARAN, Purdue University — Computational analysis of drop breakup, which is of common occurrence in nature and technology, is important for advancing understanding of pinch-off singularities and developing new technologies. During drop formation from a tube, as more liquid flows from the tube into the drop, the drop elongates and thins. At the incipience of breakup, a spherical mass – the precursor of the primary drop – is connected to the liquid in the tube by a thin thread – the precursor of one or more satellites. Numerical algorithms for analyzing this phenomenon at finite Reynolds number have been of two types: ones based on finite element methods (FEMs) and others based on various diffuse interface (DI) techniques. Numerical solutions must agree with scaling solutions of interface pinch-off, which are exact solutions of the nonlinear Navier-Stokes equations, and experiments. To date, the DI approach, despite its coarseness, has been more popular because it is simple and can predict the formation of several drops in sequence. Predictions made with FEM algorithms have been shown to be in excellent agreement with scaling theories and measurements but only until the instant of first breakup. Here we describe new FEM computations of unparalleled accuracy to predict the dynamics of continuous drop formation and support them with high-speed visualization experiments.

Osman Basaran
Purdue University

Date submitted: 03 Aug 2007 Electronic form version 1.4