

Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Fluid Dynamics of Bottle Filling PATRICK MCGOUGH, HAIJING GAO, SANTOSH APPATHURAI, OSMAN BASARAN, Purdue University — Filling of bottles is a widely practiced operation in a large number of industries. Well known examples include filling of “large” bottles with shampoos and cleaners in the household products and beauty care industries and filling of “small” bottles in the pharmaceutical industry. Some bottle filling operations have recently drawn much attention from the fluid mechanics community because of the occurrence of a multitude of complex flow regimes, transitions, and instabilities such as mounding and coiling that occur as a bottle is filled with a fluid. In this talk, we present a primarily computational study of the fluid dynamical challenges that can arise during the rapid filling of bottles. Given the diversity of fluids used in filling applications, we consider four representative classes of fluids that exhibit Newtonian, shear-thinning, viscoelastic, and yield-stress rheologies. The equations governing the dynamics of bottle filling are solved either in their full 3D but axisymmetric form or using the slender-jet approximation.

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Date submitted: 05 Aug 2011

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