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High-Fidelity Simulation of a Rotary Bell Atomizer with Electrohydrodynamic Effects VENKATA KRISSHNA, MARK OWKES, Montana State University — Rotary Bell Atomizers (RBA) are extensively used as paint applicators in the automotive industry. Atomization of paint is achieved by a bell cup rotating at high speeds (40k-60k RPM) and in the presence of a background electric field. Current estimates report a maximum paint transfer efficiency of only 60%. The atomization process in an RBA affects the droplet size and velocity distribution which subsequently control the transfer efficiency and surface finish quality. Moreover, optimal spray parameters used in industry are often obtained from expensive trial-and-error methods. In this work, a computational approach is used to simulate three-dimensional near-cup flows (mainly primary and secondary breakup) using a high-fidelity volume-of-fluid transport scheme that includes the effects of Electrohydrodynamics (EHD). This work involves the use of two meshes, one to solve the Navier-Stokes equations in the atomization region and a second on a larger region to solve for the electric field with realistic boundary conditions. This research aims to develop a cost-effective method to investigate the influence of various flow characteristics on the atomization and breakup process of the liquid.

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