Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Verification and Validation of a Continuous Adjoint Formulation for Liquid-Gas Flows[1] LAM VU, Cornell University, ALEXANDRU FIKL, DANIEL BODONY, University of Illinois Urbana Champaign, OLIVIER DESJARDINS, Cornell University — Atomization appears in a variety of engineering applications such as fuel sprays for combustion engines and powder production for additive manufacturing. The capability to perform systematic spray control is paramount to the development of atomization technologies. However, spray control represents a major challenge due, in part, to the large parameter space and to the lack of reduced order models. Consequently, spray control has traditionally been conducted based on trial and error. Spray control problems can be approached systematically by posing them as an optimization problem where the goal is to choose a set of control parameters that maximize a user-defined spray metric, the cost function. Solving this optimization problem through gradient-descent requires the evaluation of the gradient of the cost function with respect to the control parameters, which is acquired through an adjoint formulation. In this study, we verify and validate our implementation of a continuous adjoint formulation for liquid-gas flows. In particular, we confirm that the gradient calculated from the adjoint formulation agrees with the one calculated through finite differencing. Finally, we explore the application of the liquid-gas flow adjoint formulation to the control of sprays.

[1]This work was sponsored by the Office of Naval Research (ONR) as part of the Multidisciplinary University Research Initiatives (MURI) Program, under grant number N00014-16-1-2617.

Lam Vu
Cornell University

Date submitted: 31 Jul 2019 Electronic form version 1.4