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A Numerical Method for Variable Surface Tension Effects in Non-Isothermal Atomization[1] PETER BRADY, JUAN LOPEZ, MARCUS HERRMANN, Arizona State University — Atomization often occurs in non-isothermal environments, such as in combustion devices. There, thermal fluctuations can be significant on length scales associated with the liquid atomization process. Since the surface tension force is a function of local temperature, these thermal fluctuations may result in large local variations of the surface tension force, thereby potentially impacting the atomization process. Here, we present a numerical technique to incorporate these thermal Marangoni forces into the balanced force Refined Level Set Grid (RLSG) approach. With it, the liquid/gas phase interface is tracked by a level set method using an auxiliary high resolution equidistant Cartesian grid. This not only allows for application of higher-order WENO schemes retaining their full order of accuracy both for advecting and reinitializing the level set scalar, but it also provides the necessary high resolution of the phase interface geometry during topology change events in an efficient manner. Verification and validation test cases geared towards testing the applicability of the proposed methods to the case of secondary spray drop atomization will be presented.

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Marcus Herrmann
Arizona State University

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