Abstract Submitted
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Experiments on Spray from a Rolling Tire[1] CHARLES RADOVICH, FRED BROWAND, University of Southern California — A novel laboratory apparatus has been built to understand the mechanisms and statistics of droplet production for spray emerging from a rolling tire. Using high-speed imaging, water passing through a single circumferential groove was observed to leave the tire contact patch in the form of a liquid sheet of non-uniform thickness. The sheet breaks into droplets as a result of several, organized instabilities. Measurements for the breakup length of the liquid sheet showed a dependence on Weber number proportional to $We^{-1/6}$, for Weber numbers of 2700, 10900 and 24400. A technique to identify and size water droplets was developed and the distribution of droplet sizes was determined as a function of Weber number. At We = 2700, droplet sizes between 80 and $9000\mu m$ were detected, with a mean diameter near $800\mu m$. Both the range of droplet sizes and the mean diameter were found to decrease with increasing Weber number as (approximately) $We^{-1/2}$. Correlation Image Velocimetry (CIV) was used to estimate the distribution of droplet velocities as a function of droplet size. The spread of droplet velocities about the tire peripheral speed is strongly correlated with droplet size. The spread can be estimated by a simple physical model incorporating rigid droplets subject to gravity and drag.

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