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Laser Speckle Drop Profilometry Validation and Measurement of Contact Angle Variation with Surface Roughness JASON SCHMUCKER, EDWARD WHITE, JOSHUA OSTERHOUT, Texas A&M University — A non-intrusive technique has been developed that measures full-field instantaneous interface shapes of unsteady droplets on rough surfaces. Illumination of a rough surface by a collimated laser forms a speckle pattern at the solid surface that is subsequently deformed by refraction at the drop interface, encoding information about the surface height and gradient. Computer algorithms analyze the resulting images to identify the interface shape, contact line location and contact angles about the contact line. This is achieved through a minimization of the mean-squared error between the measured speckle deformation and that of the reconstructed drop using simulated annealing. Extensive validation efforts demonstrate the technique's effectiveness on aluminum, copper, and stainless steel surfaces when the surface roughness is micron scale. Preliminary experiments provide data on how contact angle variations about a single drop's contact line and between different droplets depends on surface roughness on the various surfaces.

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