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Inertia-driven droplet depinning on textured surfaces SUNGYON LEE, Department of Mechanical Engineering, Texas A&M University, BENJAMIN WILCOX, Department of Aerospace Engineering, Texas A&M University, ALIREZA HOOSHANGINEJAD, Department of Mechanical Engineering, Texas A&M University, ALEX BERGER, Department of Aerospace Engineering, Texas A&M University, FENG XU, Department of Mechanical Engineering, Texas A&M University, EDWARD WHITE, Department of Aerospace Engineering, Texas A&M University — The stability of drops on surfaces subject to forcing by wind and gravity is relevant to heat exchangers, fuel cells, and aircraft icing, and it lacks understanding in a high Reynolds number regime. To experimentally investigate this phenomenon, water drops are placed on the rough aluminum floor of a tiltable wind tunnel and brought to critical conditions for varying drop sizes, inclination angles, and flow speeds. In particular, the evolving 3D droplet shapes under flow are reconstructed based on a laser-speckle interface measurement tool, while the critical flow rates of droplet depinning are also noted. By accounting for the contact angle hysteresis and the pressure build-up in a nearly turbulent boundary layer, the critical depinning flow rate is theoretically predicted and is compared to the experimental results. We also observe and explain the transition of the drop depinning behavior from inertia-dominated to gravity-dominated regimes at non-zero inclination angles.

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