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High-Speed Droplet Impact Onto Deformable Substrates: Analysis And Simulations[1] MICHAEL NEGUS, University of Oxford, RADU CIMPEANU, University of Warwick, MATTHEW MOORE, JAMES OLIVER, University of Oxford — The impact of a high-speed droplet onto a substrate is a highly non-linear, multiscale phenomenon and poses a formidable challenge to model. In addition, when the substrate is deformable, such as a spring-suspended plate or an elastic sheet, the fluid-structure interaction introduces an additional layer of complexity. We present two modeling approaches for droplet impact onto deformable substrates: matched asymptotics and direct numerical simulations. In the former, we use Wagner's theory of impact to derive analytical expressions which approximate the behaviour during the early stages of the impact. In the latter, we use the open source volume-of-fluid code Basilisk to conduct direct numerical simulations designed to both validate the analytical framework and provide insight into the later times of impact. Through both methods, we are able to observe how the properties of the substrate, such as elasticity, affect the behaviour of the flow. We conclude by showing how these methods are complementary, as a combination of both can lead to a thorough understanding of the droplet impact across timescales.

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