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Effect of surface roughness on contact line dynamics of a thin droplet[1] DEBANIK BHATTACHARJEE, BABAK SOLTANNIA, HADI NAZARIPOOR, MOHTADA SADRZADEH, Department of Mechanical Engineering, University of Alberta — Any surface possesses inherent roughness. Droplet spreading on a surface is an example of a contact line problem. The tri-phase contact line is prone to stress singularity which can be relieved by using precursor film assumption and disjoining pressure. In this study, an axisymmetric, incompressible, Newtonian droplet spreading on a surface was investigated. An evolution equation which tracks the droplet height over time was obtained considering the lubrication approximation. The nonlinear PDE of evolution equation was solved using finite difference scheme. A simplified Gaussian model was used as a starting point to assess the role of roughness in the dynamics of contact line. The preliminary results revealed that, for both impermeable and permeable surfaces, the apparent contact angle increased in the presence of defects whereas the equilibrium stage remained unaffected. The apparent contact angle, however, was more strongly dependent on the nature and density of defects for impermeable surfaces due to the longer droplet lifetime. Furthermore, random self-affine and non-Gaussian models are employed. The mathematical model results are finally compared with theoretical models like the Cassie-Baxter, Wenzel, and Penetration modes.

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