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Forced spreading of films and droplets of colloidal suspensions LEONARDO ESPIN, SATISH KUMAR, University of Minnesota — When a thin film of a colloidal suspension flows over a substrate, uneven distribution of the suspended particles can lead to an uneven coating. Motivated by this phenomenon, we analyse the flow of perfectly wetting films and droplets of colloidal suspensions down an inclined plane. Lubrication theory and the rapid-vertical-diffusion approximation are used to derive a coupled pair of one-dimensional partial differential equations describing the evolution of the interface height and particle concentration. Precursor films are assumed to be present, the colloidal particles are taken to be hard spheres, and particle and liquid dynamics are coupled through a concentration-dependent viscosity and diffusivity. We find that for sufficiently high Péclet numbers, even small initial concentration inhomogeneities produce viscosity gradients that cause the film or droplet front to evolve continuously in time instead of travelling without changing shape as happens in the absence of colloidal particles. Our results suggest that particle concentration gradients can have a dramatic influence on interface evolution in flowing films and droplets, a finding which may be relevant for understanding the onset of patterns that are observed experimentally.

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