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Thin film flow down a porous substrate in the presence of a soluble surfactant: Linear stability analysis YADAV ANJALAIAH, R. USHA, Department of mathematics, IIT Madras, Chennai-600036, India — The linear stability of a thin film flowing down an inclined porous substrate in the presence of soluble surfactants is investigated. A surfactant model in which the surfactant has affinity only for the liquid-gas and not for the liquid-solid interface, and is contained in the bulk only as a monomer is considered. The adsorption-desorption kinetics of the surfactant at the liquid-gas interface is accounted for. An Orr-Sommerfeld eigenvalue problem is formulated and is solved analytically in the limit of long-wave perturbations and numerically for arbitrary wave-length using Spectral-Tau collocation method. The effects of solubility of the surfactant, the characteristics of the porous medium and adsorption-desorption kinetics are examined. The results reveal the stabilizing effect of soluble surfactant on the flow system. It is possible to either stabilize or destabilize the flow system by appropriately choosing the characteristics of the porous medium. The presence of soluble surfactants is shown to be more effective in stabilizing the flow system than that of insoluble surfactants.

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