

Lie group analysis and numerical solutions of thin film flow driven by gravity, surface tension and surface shear

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The equation describing the flow of a thin liquid film is analysed via Lie group theory and numerical methods. The flow is driven by surface tension, gravity and surface shear, a mass sink/source term is also included. When surface tension is neglected, stationary and new travelling wave solutions are found. With surface tension alone driving the flow stationary and separable solutions are found. With the mass source term set to zero progress is made under the assumption of small surface tension. Finally, by assuming the source term has a travelling wave form we can specify a film shape and obtain the rate at which mass must enter the system for a solution to exist. The group invariant solutions are used to determine possible boundary conditions to be used for the numerical solutions.