

The modelling of a capillary rise dynamics using a nonlinear differential equation

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Abstract

Capillary rise is an extraordinary physical process that is ubiquitous in nature and the properties of which can also be used in industry. The governing equation that describes the change in the height of the liquid column during the capillary flow in a thin vertical tube is a nonlinear ordinary differential equation of the second order. In my talk, I am going to discuss the classical mathematical model that describes the considered physical phenomenon, together with the presentation of some of its improvements. After a series of theoretical results concerning the existence and uniqueness of the solutions of the studied nonlinear equations, I will introduce a condition for changing the character of the capillary flow in a narrow cylindrical tube. Additionally, a detailed perturbation analysis will be presented in relation to the limiting values of the dimensionless parameter that appears in the considered models.