Gravity Force in Capillary Flow through Open Channels

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Due to the decrease of the free energy of liquids in reduced spaces, they can flow spontaneously through corners like filaments, with movement from the effect of capillary forces [1, 2]. The study of the fluid dynamics of these small quantities of liquids transported by angular systems is important in many areas, such as oil recovery and the design of gathering systems of condensed fluids, with capillary forces developed in the corners [3]. The studies carried out here have resulted in mathematical models that reproduce the behavior of the filaments during their formation and advance [3], furthermore incorporating some improvements [4, 5]. These models have been generated considering simplified angular systems that reject the effect of the gravity force on the formation and velocity of advance of the filaments. However, some investigations have demonstrated that the gravity force has some effect on this capillary phenomenon [6]. Starting from previous mathematical models, this work carries out an important contribution to model the behavior of liquid filaments in corners, with the inclusion of the effect of the gravity force on the formation and movement of the filaments. The model proposed is developed from a differential equation outlined in an open corner for a Poiseuille flow. The estimate of the effects generated by the gravity force allows optimizing the design of systems for handling of liquids with capillary forces developed in the corners of the open channels, where the force of gravity has an influence on the movement of the fluid.