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Mathematical Modeling of Drip Emitter Discharge of Trapezoidal Labyrinth Channel

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Abstract : The influence of the geometric parameters of trapezoidal labyrinth channel on the emitter discharge is investigated in this work. The impact of the dentate angle, the dentate spacing, and the dentate height are studied among the geometric parameters of the labyrinth channel. Numerical simulations of the water flow movement are performed according to central cubic composite design using Commercial codes GAMBIT and FLUENT. Inlet pressure of the dripper is set up to be 1 bar. The objective of this paper is to derive a mathematical model of the emitter discharge depending on the dentate angle, the dentate spacing, the dentate height of the labyrinth channel. As a result, the obtained mathematical model is a second-order polynomial reporting 2-way interactions among the geometric parameters. The dentate spacing has the most important and positive influence on the emitter discharge, followed by the simultaneous impact of the dentate spacing and the dentate height. The dentate angle in the observed interval has no significant effect on the emitter discharge. The obtained model can be used as a basis for a future emitter design.

Keywords : drip irrigation, labyrinth channel hydrodynamics, numerical simulations, Reynolds stress model.
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