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Laboratory testing on infiltration in single synthetic fractures

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An understanding of infiltration phenomena in unsaturated rock fractures is extremely important in many branches of engineering for numerous reasons. Sectors such as the oil, gas and water industries are regularly interacting with water seepage through rock fractures, yet the understanding of the mechanics and behaviour associated with this sort of flow is still incomplete.
An apparatus has been set up to test infiltration in single synthetic fractures in both dry and wet conditions.
To simulate the two fracture planes, concrete fractures have been moulded from 3D printed fractures with varying geometrical configurations, in order to analyse the influence of aperture and roughness on infiltration. Water flows through the single fractures by means of a hydraulic system composed by an upstream and a downstream reservoir, the latter being subdivided into five equal sections in order to measure the flow rate in each part to detect zones of preferential flow.
The fractures have been set at various angles of inclination to investigate the effect of this parameter on infiltration dynamics.
The results obtained identified that altering certain fracture parameters and conditions produces relevant effects on the infiltration process through the fractures. The main variables influencing the formation of preferential flow are: the inclination angle of the fracture, the saturation level of the fracture and the mismatch wavelength of the fracture.