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Determination of permeability and consolidation in saturated and unsaturated soil based on measurements in a bench scale centrifuge

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In 2011, the design of new instrumented model centrifuge was developed at Ghent University. Meanwhile, this technique is patented. Basically this device was developed for the determination of the characteristic retention curve and the permeability of soil in saturated and unsaturated soil. More recently, based on the results of the scientific research, the technique was developed towards other engineering applications, as for example, infiltration problems and the study of large strain consolidation of soils. For last mentioned application, a mathematical model for large-strain consolidation was defined based on constitutive relationships for effective stress and permeability. A numerical algorithm was developed. In this article, example, numerical problems are discussed and solution strategies are proposed to deal with anomalies in the numerical solution. Experimental tests were performed to test the feasibility of the approach. The outcome of the test was positive for pre-consolidated grounds. For slurry, vibration effects appear to be present in the used centrifuge, which are not included in the model. The development of this new technique and the simultaneous development of the scientific research and the engineering applications result in a valuable new technique for the determination of the consolidation behavior and the determination of the flow characteristics of the soil.

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