

Laboratory characterizations of unsaturated flow in accelerated gravitational fields

Hideo Nakajima[1]; Ming Zhang[1]; Mikio Takeda[1]

[1] Research Center for Deep Geological Environments, AIST

The geotechnical centrifuge has been used for study on flow in variably saturated soil by many researchers because of its ability to perform unsaturated flow observations that take longer time by other laboratory experiments. However, behavior of water at unsaturated condition in the centrifugal field is still not fully understood and there are experimental difficulties to accurately characterize rapid unsaturated flow.

In this study, feasibility of centrifuge technique for unsaturated flow was investigated from a dimensional analysis and experimental observations. A series of one-dimensional column experiments was performed to obtain the water retention characteristics of a uniform fine sand. Cumulative outflow and temporal changes of capillary pressures were measured during gravity driven drainage. Unsaturated hydraulic parameters were estimated by inverse analyses to evaluate scaling similitude of the centrifuge models. Requirements for the measurements to estimate the unsaturated parameters from the inverse analyses are discussed. A new fiber-optic miniature pore-pressure transducer developed for centrifuge and other laboratory experiments will be also presented.