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Statistical Assessment of Models for Determination of Soil–Water Characteristic Curves of Sand Soils

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Abstract : Characterization of the engineering behavior of unsaturated soil is dependent on the soil-water characteristic curve (SWCC), a graphical representation of the relationship between water content or degree of saturation and soil suction. A reasonable description of the SWCC is thus important for the accurate prediction of unsaturated soil parameters. The measurement procedures for determining the SWCC, however, are difficult, expensive, and time-consuming. During the past few decades, researchers have laid a major focus on developing empirical equations for predicting the SWCC, with a large number of empirical models suggested. One of the most crucial questions is how precisely existing equations can represent the SWCC. As different models have different ranges of capability, it is essential to evaluate the precision of the SWCC models used for each particular soil type for better SWCC estimation. It is expected that better estimation of SWCC would be achieved via a thorough statistical analysis of its distribution within a particular soil class. With this in view, a statistical analysis was conducted in order to evaluate the reliability of the SWCC prediction models against laboratory measurement. Optimization techniques were used to obtain the best-fit of the model parameters in four forms of SWCC equation, using laboratory data for relatively coarse-textured (i.e., sandy) soil. The four most prominent SWCCs were evaluated and computed for each sample. The result shows that the Brooks and Corey model is the most consistent in describing the SWCC for sand soil type. The Brooks and Corey model prediction also exhibit compatibility with samples ranging from low to high soil water content in which subjected to the samples that evaluated in this study.

Keywords : soil-water characteristic curve (SWCC), statistical analysis, unsaturated soil, geotechnical engineering
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