

Young Members Column

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I received my master's degree in Civil Engineering from Hunan University. Currently, I am a third-year Ph.D. student at Tongji University, Department of Geotechnical Engineering. Our research group is mainly oriented to solving problems encountered in civil engineering practice, such as the mechanical behavior of pile foundations for offshore wind turbines, rainfall-induced slope instability, and structure-interface stability under dry-wet cycles. I have gained much experience in the field over the past three years since I joined our group at Tongji University. I have also learned how to critically analyze experimental data and convert it into abstract physical laws that can be applied in engineering practice. I joined the International Press-in Association (IPA) on June 7, 2022, as a student member.

In the past two years, our research group studied the influence of adsorbed film on the hydraulic properties of unsaturated soil. We established a unified hydraulic constitutive model based on fractal theory for unsaturated porous media, and the title of the research work is "A fractal hydraulic model for water retention and hydraulic conductivity considering adsorption and capillarity". The model can describe the water retention characteristics and relative hydraulic conductivity of unsaturated soil in the entire suction range, as shown in Fig. 1. It is found that the pore size distribution of the soils mainly controlled the transport characteristics of capillary water, but had a slight influence on the hydraulic properties of adsorbed water, which was dominated by the type and content of minerals and specific surface area of the soil.

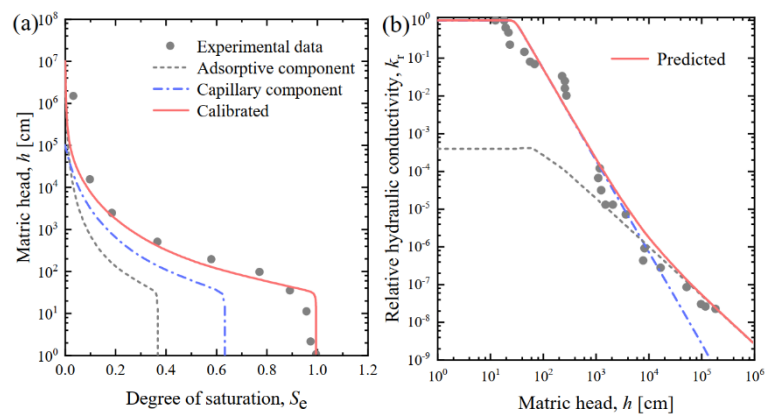


Fig.1 Measured and predicted hydraulic properties of clay loam:
(a) calibrated SWRC; (b) predicted k_r - h curve

From: <https://doi.org/10.1016/j.jhydrol.2021.126763>

The earth's surface soils are unsaturated, however, most of the research in the literature is based on saturated soils, and their effective stress equation cannot be used to estimate the stress state of unsaturated soils. Therefore, developing a more generalized mechanical framework for unsaturated soils is necessary. My research currently focuses on the mechanical behavior of unsaturated soils, including the strength characteristics and stress-strain relationship. In addition, I am also interested in the mechanical response of the unsaturated soil-structure Interface. These studies are critical for evaluating the bearing capacity of pile foundations, earth pressure development of retaining walls, and slope stability issues under wet and dry cycles. I understand that the International Press-in Association provides a great platform for engineers and researchers from different organizations and institutions to share their experiences and findings, which help to develop innovative technology for the betterment of society.