

Early-time solution for drainage in soils and foams

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ABSTRACT

Richards' equation [1] describes transport of moisture within soils during infiltration processes. It reduces to a nonlinear diffusion equation in the early stage of infiltration. Nonlinear diffusion equations such as these arise quite generally in the early time evolution of infiltration processes into porous media such as soils and foams, during which time the system is dominated by capillary-driven drainage. New solutions based on the van Genuchten [2] relative diffusivity function for soils are found at early times, and compared with the early time solutions of non-linear diffusion for channel-dominated foam drainage [3]. These solutions are found using the principle of self-similarity. The solutions obtained for the node-dominated [4] foam drainage are found in literature (the governing equation being now linear is analogous to the linear equation for heat transfer). Similarities and differences between the various solutions for nonlinear and linear diffusion are highlighted.

References

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