

Mathematical Proof of the Propagation Theory

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Some theoretical aspects of the onset of buoyancy-driven instability in an initially quiescent, isotropic fluid-saturated porous layer are considered. Darcy's law is employed to examine characteristics of fluid motion under the Boussinesq approximation. Using linear theory, we derive stability equations and transform them in the similarity domain. Based on the linear stability equations in the similarity domain, we mathematically prove the propagation theory. Temperature or concentration disturbance field is expressed as a series of the orthonormal functions and the vertical velocity one is obtained in simple recursive form. The validity of the propagation is also proved by comparing the stability characteristics under the propagation theory with those obtained from the general stability analysis.