

Analytic Solution to a Problem of Seepage in a Chequer-Board Porous Massif

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Abstract

A study is made of steady two-dimensional seepage in a porous massif composed by a double-periodic system of 'white' and 'black' chequers of arbitrary conductivity. Rigorous matching of Darcy's flows in zones of different conductivity is accomplished. Using the methods of complex analysis, explicit formulae for specific discharge are derived. Stream lines, travel times, and effective conductivity are evaluated. Deflection of marked particles from the 'natural' direction of imposed gradient and stretching of prescribed composition of these particles enables the elucidation of the phenomena of transversal and longitudinal dispersion. A model of pure advection is related with the classical one-dimensional advective-dispersion equation by selection of dispersivity which minimizes the difference between the breakthrough curves calculated from the two models.

Keywords

Advection, Conductivity, Dispersion, Double-periodic structure, Seepage