

Analysis of turbulent flows in fixed and moving permeable media

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A b s t r a c t

The ability to realistically model flows through heterogeneous domains, which contain both solid and fluid phases, can benefit the analysis and simulation of complex real-world systems. Environmental impact studies, as well as engineering equipment design, can both take advantage of reliable modelling of turbulent flow in permeable media. Turbulence models proposed for such flows depend on the order of application of volume- and time-average operators. Two methodologies, following the two orders of integration, lead to distinct governing equations for the statistical quantities. This paper reviews recently published methodologies to mathematically characterize turbulent transport in permeable media.

A new concept, called double-decomposition, is here discussed and instantaneous local transport equations are reviewed for clear flow before the time and volume averaging procedures are applied to them. Equations for turbulent transport follow, including their detailed derivation and a proposed model for suitable numerical simulations. The case of a moving porous bed is also discussed and transport equations for the mean and turbulent flow fields are presented.

Key words: turbulent flow, porous media, moving bed.