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A.F. Miguel
Geophysics Centre of Évora
University of Évora
Évora, Portugal

Fluid Flow in a Porous Tree-Shaped Network

A. F. Miguel[1,2]

[2]Geophysics Centre of Évora, Évora, Portugal
[3]Department of Physics, University of Évora, Évora, Portugal

Tree-shaped flow networks connect one point to an infinity of points and are everywhere in Nature [1-3]. These networks often own minimal flow resistance and vessel sizes obey to scaling power-laws [1,3]. Bejan and co-authors [1,4-6] showed that the generation of tree-shaped networks occurs in the pursuit of global thermodynamic performance subject to constraints. They also obtained vessel sizes relationships similar to those reported in the literature [7]. Tree-shaped networks for cooling [8], applications for single-phase flow and two-phase flow [1,9], applications for heat and mass exchangers [10], microvascular lab-on-a-chip systems [11] and embedded dendritic vasculatures for smart materials with volumetric functionalities, such as self-healing and self-cooling [12,13] have been proposed in the literature.
In this paper presents a model for fluid flow through a tree-shaped network with porous tubes. Hagen–Poiseuille flow is assumed for tubes and Darcy flow for the porous wall.

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