

HOMOGENIZATION OF THE STOKES FLOW IN A CONNECTED POROUS MEDIUM

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Abstract. In this paper we prove the convergence of the homogenization process of the Stokes equations with Dirichlet boundary condition in a periodic porous medium. We consider here the case where the solid part of the porous medium is connected, and we generalize to this case the results obtained by Tartar (1980).

Introduction

We define a porous medium as the periodic repetition in a bounded domain Ω of an elementary ε -sized cell in which the solid part of the porous medium is also of size ε . A typical case of such a porous medium is a regular lattice of interconnected cylinders (see Fig. 1). Let Ω^ε be the fluid part contained in Ω . The flow of an incompressible viscous fluid in Ω^ε under the action of an exterior force f is ruled by the Stokes equations (S_ε) with Dirichlet boundary condition:

$$(S_\varepsilon): \quad \begin{aligned} \Delta p_\varepsilon - \Delta u_\varepsilon &= f & \text{in } \Omega^\varepsilon, \\ \nabla \cdot u_\varepsilon &= 0 & \text{in } \Omega^\varepsilon, \\ u_\varepsilon &= 0 & \text{on } \partial\Omega^\varepsilon \end{aligned}$$

$(u_\varepsilon, p_\varepsilon)$ being the velocity and the pressure of the fluid.

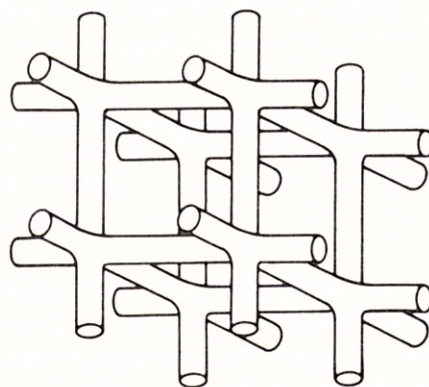


Fig. 1.