

Abstract Submitted
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An exact solution for Stokes flow in an infinite channel with permeable walls¹ GREGORY HERSCHLAG, JIAN-GUO LIU, ANITA LAYTON, Duke University — We derive an exact solution for Stokes flow in an infinite channel with permeable walls. We assume that at the channel walls, the normal component of the fluid velocity is described by Darcy’s law and the tangential component of the fluid velocity is described by the no slip condition. The pressure exterior to the channel is assumed to be constant. We verify that in the limit of small permeability, Poiseuille flow is recovered to leading order, and demonstrate that our exact result agrees with previous approximate results in this limit. By comparing our solution to existing assumptions on inlet profiles in the literature, we find that although the error is small, Poiseuille and Berman flow do not provide correct inlet conditions.

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