

# On the Selection Problem for the Hele-Shaw Flow

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By casting the Saffman–Taylor problem for the Hele–Shaw fingering, into a dam–like problem, gives new insight on the  $\lambda = \frac{1}{2}$  selection mechanism. In particular the thrust of the fluid across the  $x$ –section of the channel at the nose of the finger is maximized for  $\lambda = \frac{1}{2}$ . This and other results are derived from a precise asymptotic expansion of the solution for  $x \rightarrow \infty$ . The latter is made possible by a novel variational–like setting of the problem, formally similar to an obstacle problem. We establish that such variational–like solutions exist even for quite irregular fingers. These solutions are shown to be unique up to a translation of the  $x$ –axis.