Taylor–Dean instability in channels with slowly varying curvature and gap-width

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The classical Dean problem is modified by letting the radius of curvature of the channel and the channel thickness be functions of a slow variable $S=\delta x$. By taking Taylor–Dean disturbance theory to $O(\delta^{1/2})$, modifications to the spatial growth rate of the local problem are obtained. These are studied for three examples and it is found that divergence of the channel is destabilizing and convergence is stabilizing.