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**Nonlinear stability of wall-bounded viscous flows** SHIXIAO WANG, Auckland University, HARRY LEE, University of Michigan — A viscous extension of Arnold's inviscid theory for planar shear flows is developed and a viscous Arnold's identity is obtained. The viscous Arnold's identity is revealed to be closely related to the perturbation's enstrophy identity (Synge 1938). The mechanism of linear instability/stability of wall-bounded shear flows has been re-examined by the viscous Arnold's identity and the perturbation's enstrophy identity. It was found that the role of non-slip wall boundary condition in a planar shear flow is strikingly different from that in the circular Taylor-Couette flow confined between two concentric rotating cylinders. For the former, the perturbation's enstrophy is generated at the walls by the non-slip induced flow rubbing effect. For the latter, however, the perturbation's flow circulation is rigidly fixed by the non-slip wall condition and thus it effectively stabilizes the flow globally under axisymmetric disturbances within a sub-domain of the inviscid linear stability regime. A remarkable feature of the global stability for the circular Taylor-Couette flow is its independence of the $Re$ number.

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