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Onset of 'stitching' in the fluid mechanical 'sewing machine' NEIL RIBE, Institut de Physique du Globe de Paris, JOHN LISTER, SUNNY CHIU-WEBSTER, Department of Applied Mathematics and Theoretical Physics, University of Cambridge — A thin thread of viscous fluid that falls on a moving belt acts like a fluid mechanical 'sewing machine', exhibiting a rich variety of 'stitch' patterns including meanders, side kicks, slanted loops, braiding, figures-of-eight, W-patterns, and period-doubled patterns (Chiu-Webster and Lister, J. Fluid Mech., in press). Using a numerical linear stability analysis based on asymptotic 'slender thread' theory, we determine the critical belt speed and frequency of the first bifurcation, at which a steady dragged viscous thread becomes unstable to sideways oscillations ('meanders'). The predictions of the stability analysis agree closely with experimental measurements. Moreover, we find that the critical belt speed and frequency for meandering are nearly identical to the contact point migration speed and the frequency, respectively, of steady coiling of a viscous thread on a stationary surface, implying a remarkable degree of dynamical similarity between the two phenomena.

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