Abstract Submitted
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Bending and buckling of viscoplastic threads IAN HEWITT, NEIL BALMFORTH, University of British Columbia — We use a slender body theory to describe the dynamics of a thin viscoplastic thread undergoing extrusion, such as occurs when squeezing toothpaste from a tube. The theory adopts the Bingham model for a yield stress fluid, together with an asymptotic approximation for the stress and strain-rate profiles across the narrow width of the thread, which imply that the thread must either be rigid or fully yielded across its entire width. A compact description of the resultant longitudinal stress and moment acting on the thread allows these yielded and unyielded regions to be identified for given external forces. The theory is applied to extrusion flows; the yield stress prevents any deformation until a critical length of extrusion is reached, after which the dynamically evolving yielded regions mediate a distinctive drooping of a horizontal beam, or a catastrophic collapse of an upright beam.

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