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Geometric theory of garden hose instability[1] VAKHTANG PUTKARADZE, Univ of Alberta, FRANCOIS GAY-BALMAZ, Ecole Normale Superioure, Paris — We derive a fully three-dimensional, geometrically exact theory for flexible tubes conveying fluid. The theory also incorporates the change of the cross-section available to the fluid motion during the dynamics. Our approach is based on the symmetry-reduced, exact geometric description for elastic rods, coupled with the fluid transport and subject to the volume conservation constraint for the fluid. We analyze the fully nonlinear behavior of the model when the axis of the tube remains straight. We then proceed to the linear stability analysis and show that our theory introduces important corrections to previously derived results, both in the consistency at all wavelength and in the effects arising from the dynamical change of the cross-section. Finally, we derive and analyze several analytical, fully nonlinear solutions of traveling wave type in two dimensions. We show that in all cases, the change of cross-section plays an important role in the dynamics.

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