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Buckling of a thin rod under cylindrical constraint JAY MILLER, MIT, TIANXIANG SU, Harvard University, NATHAN WICKS, JAHIR PABON, Schlumberger-Doll Research, KATIA BERTOLDI, Harvard University, PEDRO REIS, MIT — We investigate the buckling and post-buckling behavior of a thin elastic rod, under cylindrical constraint, with distributed loading. Our precision model experiments consist of injecting a custom-fabricated rod into a transparent glass pipe. Under imposed velocity (leading to frictional axial loading), a portion of the initially straight rod first buckles into a sinusoidal mode and eventually undergoes a secondary instability into a helical configuration. The buckling and post-buckling behavior is found to be highly dependent on the system's geometry, namely the injected rod length and the aspect ratio of the rod to pipe diameter, as well as material parameters. We quantify the critical loads for this sequence of instabilities, contrast our results with numerical experiments and rationalize the observed behavior through scaling arguments.

Jay Miller
MIT

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