Buckling of a Flexible Strip Sliding on a Frictional Base ALEXANDRE HUYNEN, University of Liege, JULIEN MARCK, University of Minnesota, VINCENT DENOEL, University of Liege, EMMANUEL DETOURNAY, University of Minnesota — The main motivation for this contribution is the buckling of a drillstring sliding on the bottom of the horizontal section of borehole. The open questions that remain today are related to the determination of the onset of instability, and to the conditions under which different modes of constrained buckling occur. In this presentation, we are concerned by a two-dimensional version of this problem; namely, the sliding of a flexible strip being fed inside a conduit. The ribbon, which has a flexural rigidity $EI$ and a weight per unit length $w$, is treated as an inextensible elastica of negligible thickness. The contact between the ribbon and the wall of the conduit is characterized by a friction coefficient $\mu$. First, we report the result of a stability analysis that aims at determining the critical inserted length of the ribbon $\ell_c(\mu)$ (scaled by the characteristic length $\lambda = (EI/w)^{1/3}$) at which there is separation between the strip and the conduit bottom, as well as the buckling mode. Next, the relationship between the feeding force $F$ and the inserted length $\ell$ after bifurcation is computed. Finally, the results of a “kitchen table” experiment involving a strip of silicon rubber being pushed on a plank are reported and compared with predictions.

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