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Pattern formation by deposition of a thin elastic rod on a moving substrate MOHAMMAD KHALID JAWED, Massachusetts Institute of Technology, FANG DA, EITAN GRINSPUN, Columbia University, PEDRO REIS, Massachusetts Institute of Technology — We report on the formation of coiling patterns when a thin elastic rod is deposited onto a moving solid boundary. We combine precision model experiments with cutting-edge computational mechanics tools ported from the computer graphics community. In our experiments, we deposit elastomeric rods onto a conveyor belt. Our numerical tool simulates the experimental scenario by implementing a discrete notion of bending and twist of the thin rod, based on discrete differential geometry, exhibiting excellent performance and robustness. The synergy between experiments and numerics, and the excellent agreement between the two, allows us to identify the key physical ingredients of the process, explore the phase diagram of the system, quantify the influence of the control parameters and rationalize the underlying mechanical instabilities. The gained predictive understanding of this geometrically-nonlinear pattern formation process has potential applications ranging from the micron-scale (coiling of carbon nanotubes) to the kilometer-scale (laying down of transoceanic undersea cables).

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