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**Slinky Mechanics: Static Shapes and Unstable States** DOUGLAS HOLMES, Virginia Tech, ANDY BORUM, University of Illinois at Urbana-Champaign, BILLY MOORE, RAYMOND PLAUT, DAVID DILLARD, Virginia Tech — The floppy nature of a tumbling Slinky has captivated children and adults alike for over half a century. Highly flexible, the spring will walk down stairs, turn over in your hands, and–much to the chagrin of children everywhere–become easily entangled. The Slinky is an educational tool for demonstrating standing waves, and a structural inspiration due to its ability to extend to many times beyond its initial length without imparting plastic strain on the material. In this work, we provide a mechanical model that captures the static equilibrium configurations of the Slinky in terms of its geometric and material properties. We present both continuous and discrete models to capture a Slinky's static equilibria and unstable transitions. We compare these with experimental results obtained for the Slinky's static equilibrium shapes. We emphasize the importance of modeling coil contact, and determine the critical criteria for the Slinky to topple over in terms of a tilt angle, and the vertical displacement of one bale of coils. Finally, we provide a general description of highly flexible helical springs by considering the nondimensional potential energy of the spring, which characterizes the "Slinkiness" of a spring.

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