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Apparatus and method to test beam structures with two or more stable configurations

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Category
Materials Science & Nanotechnology/Materials Testing & Characterization Tools

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Researchers at Purdue University have developed a novel method for testing beam structures that have two or more bistable configurations. Bistable beams present a unique challenge to existing testing methods due to the inherent difficulty maintaining continuous contact between the specimen and the testing configuration. However, with this innovative design, any industry that utilizes mechanical testing will be able to accurately evaluate bistable beams. Unlike conventional setups, this novel system facilitates continuous contact during both loading and unloading. This allows the capture of two load-displacement curves of bistable specimens, providing a comprehensive assessment of their energy dissipation capacities with unprecedented precision. The effectiveness of this novel design also enhances repeatability and reliability for companies seeking cutting-edge advancements in mechanical testing and materials analysis.

Technology Validation:

This novel apparatus was created as part of a research project testing hierarchical tape springs, which could not be adequately evaluated using existing set ups. With the newly created apparatus, researchers were able to generate continuous loading and unloading curves as the apparatus maintained constant contact with the tape springs. In this experiment, each tape spring design underwent multiple loading and unloading cycles, demonstrating the repeatability of tests conducted using the new apparatus and providing a robust understanding of the mechanical behavior and energy dissipation capacities of the hierarchical tape springs.

Advantages:

-Allows accurate testing of bistable specimens

-Unique design enables continuous contact with bistable specimens, the principal limitation in testing these kinds of specimens up to this point

-Captures both loading and unloading load-displacement curves

-Comprehensive assessment of the energy dissipation capacities of specimens

Applications:

-Materials testing and characterization

-Aerospace engineering

-Mechanical testing

TRL: 4

Intellectual Property:

Provisional-Patent, 2024-10-24, United States

Keywords: Bistable beam testing,Mechanical load-displacement analysis,Energy dissipation measurement,Continuous contact test setup,Advanced materials characterization,Bistable structure evaluation,Precision mechanical testing,Repeatable load-unload curves,Nonlinear structural testing,Aerospace component validation