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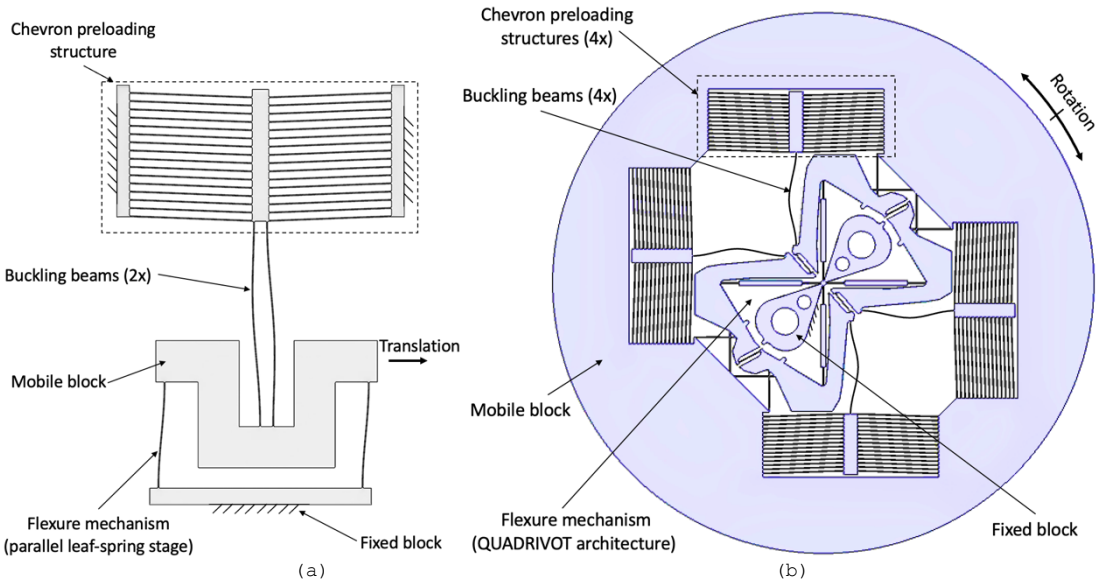
Licensing Opportunity

TTO – Technology Transfer Office

Prestressed chevron structures for stiffness reduction of flexure mechanisms



New residual stress chevron preloading structures to reduce the stiffness of flexure mechanisms, for instance: (a) a parallel leaf spring stage and (b) a QUADRIVOT exact-rotation flexure pivot that can be used as an oscillator with reduced oscillation frequency.

Ref. Nr

6.2564

Keywords

Residual stress, Chevron structure, Thermal oxidation of silicon, Beam buckling, Flexure mechanism, Bistable mechanism, Stiffness reduction

Intellectual Property

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Publications

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Description

At macroscale, the preloading of flexure mechanisms for stiffness reduction or to enable nonlinear characteristics (e.g., bistability) is easily performed. However, at microscale, conventional preloading is usually avoided due to the limitation of space, adjustment precision and the risk of damaging the device. Residual stress, on the other hand, can be highly beneficial to permanently preload flexure mechanisms. However, its primary disadvantage is often its limited preloading strain, resulting in small buckling deflection if the beams are fixed at both ends to the substrate and/or in minimal stroke for flexure mechanisms.

The invention consists of a new chevron preloading structure based on a series of beam arranged in a V-shape - chevron architecture - that aims to amplify the effect of the residual stress to efficiently preload compliant mechanisms. Buckling beams connected in-between the flexure-based mechanism and one or more chevron preloading structures can advantageously modify the mechanism intrinsic stiffness.

Advantages

- As the resulting structures can be planar, they can be manufactured and prestressed using existing MEMS technologies (e.g., Deep Reactive Ion Etching and thermal oxidation of silicon).
- The frequency of flexure oscillators can be reduced without modifying its balance inertia and without decreasing its support stiffness.
- The stiffness non-linearity (e.g., 2nd order) can be tuned, leading to a precise control of the isochronism for time-base oscillators.

Applications

- Horology: Oscillators for mechanical time bases.
- Aerospace and astrophysics: Low-stiffness guiding mechanisms (which can be actuated by low-power actuators).
- Robotics: Low-stiffness guiding mechanisms.
- MedTech: Flexure-based surgical tools.
- MEMS: Micro-mechanisms requiring a low stiffness or bistable behaviors.