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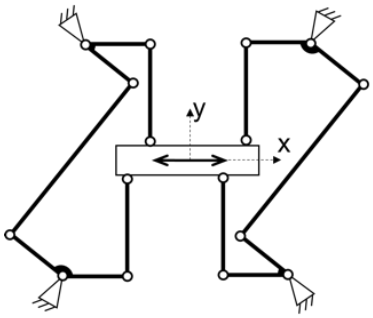
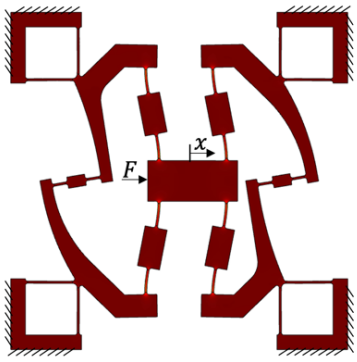
Licensing Opportunity

TTO – Technology Transfer Office

Flexure-based rectilinear stage family with near-zero parasitic shift and high support stiffness



(a)



(b)

(c)

(a) One of the kinematic configurations of the novel rectilinear stage family. (b) Flexure-based implementation of the mechanism in deformed position. (c) Fabricated silicon rectilinear flexure stage preloaded by thermally oxidized buckled beams for stiffness reduction along the translational direction.

Ref. Nr / Date

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Keywords

Flexure-based guiding mechanism, rectilinear stage, zero parasitic shift, high support stiffness

Intellectual Property

EP24218366.3: Tissot-Daguette, L., Vallat, C., F. Cosandier, F., Henein S. One degree of freedom linear stages with minimised parasitic shift (2024).

Publication

Tissot-Daguette, L., Vallat C., Nijenhuis, M., Cosandier F., Henein, S. Near-Zero Parasitic Shift Rectilinear Flexure Stages Based on Coupled n-RRR Planar Parallel Mechanisms. Machines. 2025; 13(6):530. https://doi.org/10.3390/machines13060530

Description

Flexure-based linear stages have become prevalent in precision engineering; however, most designs suffer from parasitic shifts that degrade positioning accuracy. Conventional solutions to mitigate these parasitic motions often compromise support stiffness, reduce motion range, and increase structural complexity. This patent covers a novel family of flexure-based rectilinear-motion stages using coupled n-RRR planar parallel mechanisms, achieving extremely low parasitic shifts while addressing the forementioned limitations.

Advantages

The family covers a variety of architectures with three or more main arms with symmetrical, isostatic and hyperstatic variants. All the structures are 2D, which allows for a direct implementation with flexures, allowing for highly repeatable motions, no friction between mechanical elements, no wear, no required lubrication, and the possibility for monolithic fabrication.

Thanks to their optimized architectures, the mechanisms have a large range of motion, a high support stiffness and have the possibility to be preloaded – for example via buckled beams – for drastic stiffness reduction along the moving direction or bistable functionalities.

Furthermore, the flexure-based mechanisms can be manufactured and prestressed using existing MEMS technologies (e.g., Deep Reactive Ion Etching and thermal oxidation of silicon).

Applications

- Robotics: High-precision large-stroke positioning stages, typically compatible with voice coil and piezoelectric actuators.
- Aerospace and astrophysics: High-precision large-stroke high-support-stiffness positioning stages.
- MEMS: High-support-stiffness comb-drive stages for actuators and sensors. Accelerometers and gravimeters with high sensitivity if stiffness reduction is provided. Rectilinear bistable switches if the stage is sufficiently preloaded.