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Licensing Opportunity **TTO – Technology Transfer Office**

Near-zero Parasitic Shift Remote Center of Motion Flexure-based Pivot

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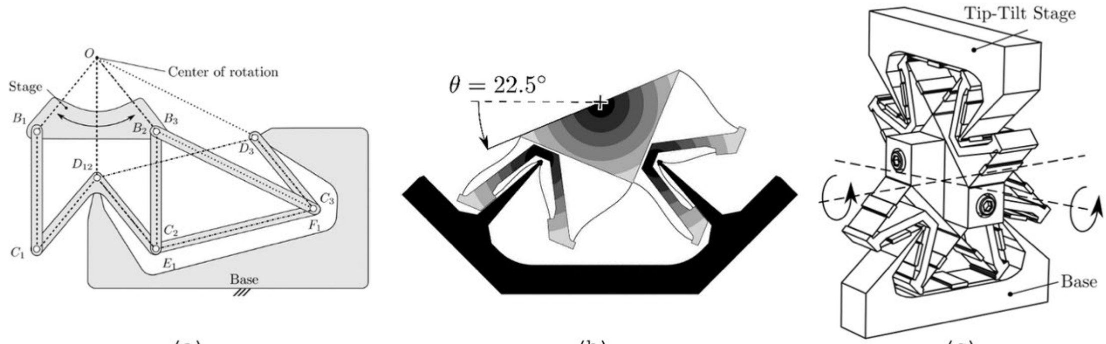
Intellectual Property

EP25210443. Vallat, C., Henein, S. (2025). Remote centre of motion pivot mechanism.

Publication

Vallat, C., Henein S., New Family of Near-zero Parasitic Shift Remote Center of Motion Flexure-based Pivot, EngrXiv Preprint, 2026



(a) (b) (c)

(a) Rigid body kinematic of the RCM mechanism (b) Flexure-based planar RCM pivot displacement field (c) Serial arrangement of two planar RCM creating a frictionless and wear free universal joint.

Description

Remote Center of Motion (RCM) pivot mechanisms are 1-DOF pivots whose axis of rotation is located outside of the physical structure of the mechanism. This invention extends the performance of flexure-based RCM pivots by precisely compensating for parasitic motion, improving restoring torque linearity, and enhancing radial stiffness and angular stroke. A first implementation realizes a planar, exactly constrained flexure-based RCM pivot with no second-order parasitic motion and nearly constant angular stiffness. A second one exploits redundant topologies to suppress parasitic motion while increasing radial stiffness without compromising angular stroke or restoring moment linearity, thereby overcoming the inherent trade-off of the known overconstrained flexure pivot designs. A third one enables a large-stroke of ±45°without internal degrees of freedom or parasitic motion.

Advantages

Optimized versions of these novel mechanisms lead to:
- Sub-micrometric parasitic translations of the axis of rotation
- Angular rotation range up to ±45°
- High in-plane and out-of-plane support stiffness
- Direct compatibility with stiffness compensation via elastic preloading
- No internal degrees of freedom
- Easy to manufacture planar designs

Industrial Applications

- Optics and Photonics: Precision mirror pointing stages with the virtual pivot located directly at the reflective surface.
- Aerospace: High-precision, large-stroke high-support-stiffness flexure hinges with infinite lifetime and no friction.
- MEMS: Ultra-sensitive rotation sensor using near-zero stiffness flexure pivot.
- Robotics: Exoskeleton or wheelchair kinematics with perfectly matching human joint axes. Limited stroke monolithic backlash-free flexure joints.
- Surgical manipulators: New category of RCM mechanisms for minimally invasive instruments with remote actuation.
- Horology: Oscillator with high quality factor, improved isochronism, gravity insensitive behaviour.