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Planar Positioning Mechanism

Ultralow-profile plate-and-disk stage steers probes anywhere in a sealed wind-tunnel section, enabling continuous maps without leaks or bulky robots.

Purdue engineers have designed a planar positioning mechanism that couples the translation of a rectangular plate with the rotation of a disk to steer a probe anywhere inside a wind-tunnel test section while keeping the duct fully sealed. The thin plate slides spanwise, and the disk rotates within it, giving the probe two degrees of freedom that cover the full streamwise and spanwise field without wall slots or bulky robot arms. By letting all data points be gathered in one continuous run, the system reduces test time, preserves identical inlet conditions, and avoids leakage that would disturb flow quality. The compact assembly fits into 11 millimeters of wall thickness, so existing tunnels can adopt it with minimal retrofit.

Technology Validation:

Finite-element models confirm structural safety from vacuum up to several-bar overpressure, and friction analyses show standard linear actuators and a built-in worm-gear train supply more than enough thrust and torque for smooth motion.

Advantages

-Full two-dimensional probe travel without compromising seal integrity

-Low profile and low intrusion compared with stacked linear stages or articulated robots

Applications

-Wind-tunnel instrumentation for aerospace and turbomachinery firms

-Research test sections at universities and national labs

-In-situ optical or thermal mapping of heat exchangers and aerodynamic components

TRL: 2

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Robotics & Automation/Perception & Sensing
Robotics & Automation/Automation & Control

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