Rotary Mechanism for Lab-on-a-Chip Microvalves (#3091)

Novel micromechanism provides rotational motion for applications in microfluidic and other MEMS devices

This invention features a novel in-plane rotary bistable mechanism (IPRBM) that can produce rotational motion in microelectromechanical system (MEMS) devices. Designed particularly for use in microfluidic systems, this MEMS component overcomes the limited mechanical displacement provided by typical linear micromechanisms. Georgia Tech researchers have leveraged this IPRBM to produce a rotary gate microvalve that operates on a chip with a small sample volume, rapid response time, and low power consumption while maintaining a high flow rate. It relies on the bistable mechanism to provide rotary motion and regulate the flow path of the microvalve design. This rotary mechanism has several additional applications, including in opto-MEMS devices, biomedical devices, microlocks, and sensors.

Benefits/Advantages

- **Versatile**: Has an adaptable design that can be adjusted based on the substances in use, stability requirements, and shape of the device
- **Efficient**: Manages a high flow rate while maintaining a low power consumption
- **Widely applicable**: Demonstrates potential for use in a wide range of microdevices that require rotational motion

Potential Commercial Applications

- Microfluidic systems
- Microlocks
- Optical shutters and switches
- Angular sensors
- Biomedical devices

Background/Context for This Invention

Micromechanisms are an important part of MEMS devices and are often integrated with an actuator to produce motion in various microfluidics and lab-on-a-chip technologies. Typically, MEMS components generate linear motion, as in accelerometers or object manipulators. The Georgia Tech research team, however, found that a rotary device could provide more power to move substances under study in lab-on-a-chip settings while still maintaining a high level of energy efficiency. Microvalves are essential components to provide control of fluid flow in miniaturized fluidic systems. Georgia Tech's IPRBM also performs with

minimal energy through a novel latching mechanism, a challenge for conventional components of microfluidic systems.

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More Information

U.S. Patent Issued - 8,220,777

Publications

Design of fully compliant, in-plane rotary, bistable micromechanisms for MEMS applications, Sensors & Actuators A: Physical, February 28, 2007

Images:

The automated sequential delivery of multiple fluids. A varying number of delay gates imprinted in the branches are shown in the figure.

COVID-19 and flu saliva test on paper: (A) The automatic sequential delivery of multiple reagents required for virus test; (B) Water pouring into the device triggers the virus assay, allowing the presence of SARS-CoV-2 and influenza A & B viruses to be visually identified by the color changes in the corresponding detection spot