

Research highlights

Innovative microactuators: Compact 3.5 mm cubic rotary-linear piezoelectric actuator

Microactuators are critical components for industrial applications such as MEMS, micro-medical devices, and microrobotics. However, the fabrication of increasingly sophisticated, millimeter sized microactuators is complicated and proving to be a challenge.

Here, in an innovative approach, Tomoaki Mashimo has fabricated a miniature rotary-linear piezoelectric actuator with a single cubic stator with a side length of only 3.5 mm, which is capable of generating both rotary motion around its central axis and linear motion in the axial direction.

The stator consisted of a single metallic cube with a side length 3.5 mm, a 2.5-mm-diameter through-hole, and four piezoelectric elements bonded to the sides of the stator. The simplicity of the design enabled the fabrication of a compact actuator, without requiring any special manufacturing procedures.

The resultant rotary and linear velocities obtained were approximately 24 rad/s and 80 mm/s, when the applied voltage was 42 Vrms at each resonant frequency. The maximum torque and thrust force were 2.5 μ Nm and 2.6 mN, respectively.

Mashimo expects further miniaturization and improvement in the performance of this compact actuator. "We foresee micro-robotic and medical applications using the rotary-linear piezoelectric microactuator," says Mashimo. "The microactuator simple design lends itself to many other applications as well."

- Tomoaki Mashimo¹, and Shigeki Toyama²
- Rotary-Linear Piezoelectric Actuator with a Cubic Stator of Side Length of 3.5 mm
- *IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control*, **57**, pp. 1825–1830, (2010).
- Digital Object Identifier (DOI): 10.1109/TUFFC.2010.1621
- ¹Tomoaki Mashimo is now at the Electronics-Inspired Interdisciplinary Research Institute (EIIRIS), Toyohashi University of Technology.
- ²Tokyo University of agriculture and Technology, department of Mechanical system Engineering, Tokyo, Japan.
- Related website: Electronics-Inspired Interdisciplinary Research Institute (EIIRIS) <http://www.eiiris.tut.ac.jp/>



Tomoaki Mashimo

