# A NEW PIEZO-DRIVEN MICRO ROBOT USING FORCED VIBRATION OF CONTINUA

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**Introduction.** The ideal micro robot in general is that with a maximum of mobility (minimum of power consumption) and a minimum of complexity (minimum of components) [1]. In this article a small robot for the 2-dimensional movement on flat ground is presented, that is driven by a single piezoelectric actuator. These actuators are characterized by a high energy efficiency which converts more than 90% of the electrical energy into mechanical energy [2].

**Design.** The robot presented in figure consists of three parts: information system, power supply and vibration system. The vibration system is formed by a triangular plate with a piezo unimorph bonded on it. At the corners of the plate three non classical legs are fixed, which serve as contact points to the surface.

**Principle of motion and control.** The aim is to use forced vibration of continua of plates and beams. The triangular plate is excited by the bending vibrations of the actuator. The different vibration forms are transformed by the legs to transversal and longitudinal vibrations. The trajectory corresponds to the mass distribution of the carrying body and can be controlled by the excitation frequency of the actuator.

**Experiments.** The locomotion of the robot on different materials was investigated. The legs are activated by different frequencies. The vibration of the legs is influenced by the surface material. The best mobility is performed on glass and steel. The locomotion velocity is reduced on wood and acrylic glass. At some frequencies even a change of the movement direction can be observed.

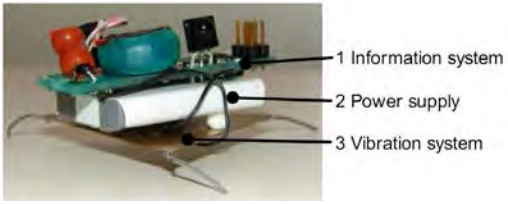


Figure – Piezo-driven micro robot

**Literature**

1. Zimmermann, K.; Zeidis, I.; Behn, C.: Mechanics of Terrestrial Locomotion. Berlin. Springer, 2009.

2. Abaza, K.: Ein Beitrag zur Anwendung der Theorie undulatorische Lokomotion auf mobile Roboter. Dissertation at Ilmenau University of Technology, 2007.