Visions to Products

# Energy Harvesting Technologies
## Self-Tunable Vibration Energy Harvester

Energy harvesters based on vibrations are still not established in industrial environments. A main obstacle is the application specific characteristic of the physical principle: conventional vibration energy harvesters exhibit a fixed Eigen-frequency, which cannot be altered afterwards. If this Eigen-frequency coincides with a dominant frequency in the excitation spectrum, the energy harvester operates in resonance with maximum energy conversion effectiveness. In most applications however, the dominant frequency varies over time in accordance with the operating mode of the machine. In this case effective energy conversion becomes a random event.

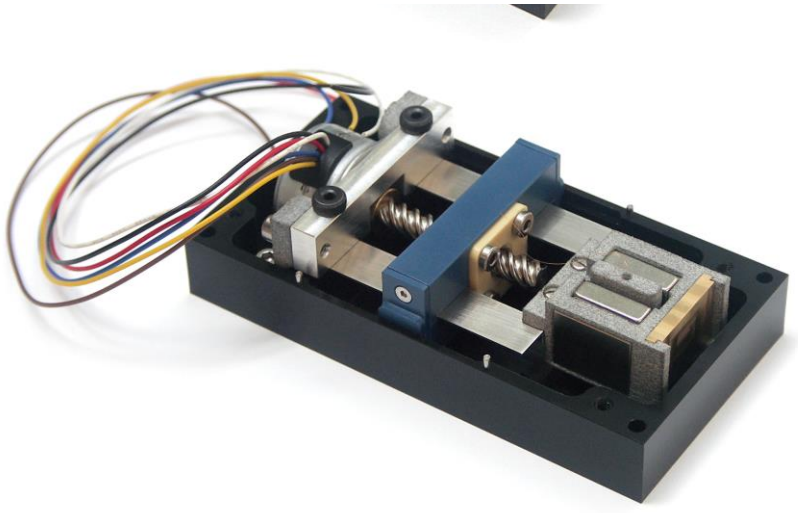

**Fig. 1:** Self-Tunable Vibration Energy Harvester (AMELI 4.0)

### Key features

- Electromagnetic energy conversion
- Closed magnetic circuit
- Continuous tunable Eigen-frequency
- Integrated power-management
- Microcontroller for self-tuning
- Bandwidth: 24 Hz
- Lower Bound: 23 Hz
- Upper Bound: 47 Hz
- Voltage output: 3.3 V DC
- Power output: 1-5 mW @ 0.2g
- Size: 100 x 55 x 35 mm³
- Weight: 230 g

Engineers at Hahn-Schickard developed a kinetic energy harvesting device, which adapts to the current vibration condition of a machine. The tuning mechanism is based on a mechanical principle: the adjustment of the Eigen-frequency is performed by changing the length of the cantilever beam. Within a displacement range of 25 mm a tunable frequency bandwidth of 24 Hz is achieved. The lower bound of the frequency band is 23 Hz, which corresponds to a rotation speed of nearly 1400 UPM. Together with an upper bound of 47 Hz (2820 UPM) the present device is ideal for harvesting energy from speed controlled power units driving pumps, grinding spindles or gear boxes.

In future, adaptive energy harvesting systems will be an important part of condition monitoring systems and embedded sensor systems (cyber physical systems) for achieving a more efficient and economic operation than it is the case today.

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

R0

**Hahn-Schickard-Gesellschaft für angewandte Forschung e.V.**
Wilhelm-Schickard-Str. 10
78052 Villingen-Schwenningen, Germany

Phone: +49 7721 943-0
Fax: +49 7721 943-210
E-mail: info@Hahn-Schickard.de
Website: www.Hahn-Schickard.de

**Contact**
Dr. Daniel Hoffmann
Phone: +49 7721 943-187
E-mail: Daniel.Hoffmann@Hahn-Schickard.de