Power-Energy-Harvesting in Harsh Environments!

Schedule:

- Short Introduce of the Companies
- Acceleration, Vibration
- Structural mechanics
- Wireless Sensor Notes (WSN)
- MST-Sensors
- Batteries
- Energy Harfesting
- Power-Kinetic-Energy-Converter-Concepts

CADwalk GmbH & Co. KG simulate Semiconductor-Devices for highest Frequencies in III-V-Technology and is developing „Wireless Sensor Notes" WSN since more than fifteen Years.

Simulation:

We build III-V-Layers in CAD and caluculate in FEM-Simulations e.g. current characteristics.

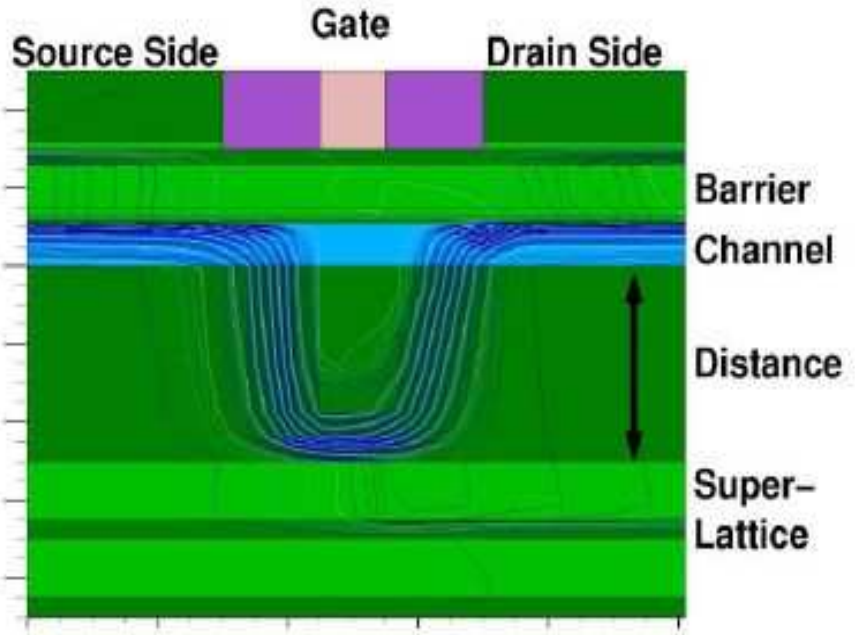

Figure 4: Device simulation: current flow lines for Lg=100nm, Vds=2.5V and Vg=-0.8V

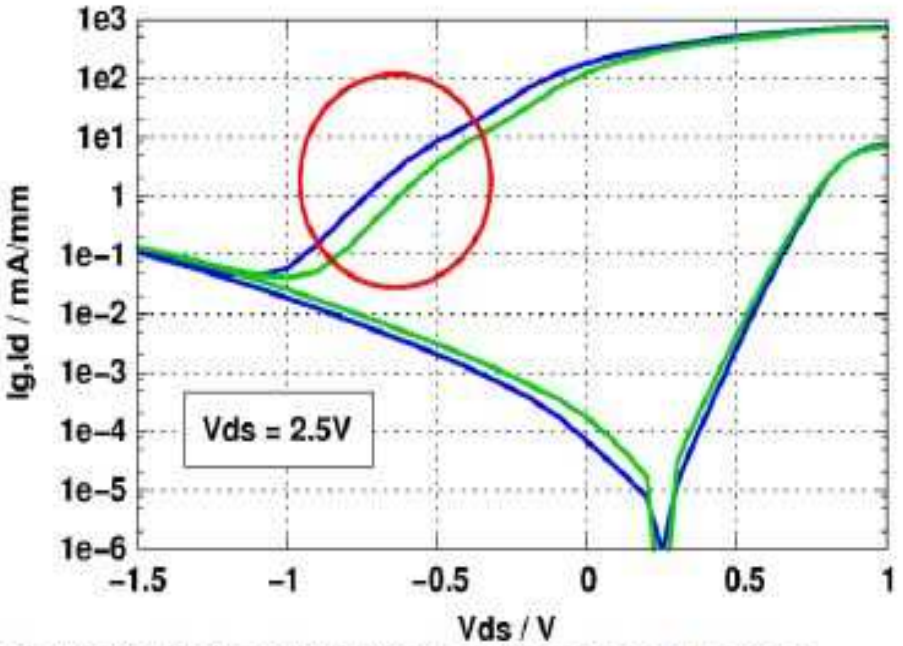

Figure 2: Device simulation: drain and gate leakage currents for 100nm gate length HEMTs with different distances between Schottky contact and channel

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Wire less Sensor Notes

CADwalk integrates synergetic concepts to create necessary functionality at minimized costs and cost of ownership.
With a small microcontroller, a dual-axis MEMS-sensor, a very thin lithium-polymer battery and an ultra flat Bluetooth transceiver we build one of the smallest, most useful, time and cost saving wireless-acceleration-measurement-system for the automation-, semiconductor- and flat-panel-industry.
It clearly watches jitter and not allowed touches during a handling sequence.

Fa. RAMPF 1926

HISTORY

What was started in 1926 as a blacksmith shop, has evolved into the leading company for concrete product molds. Worldwide.

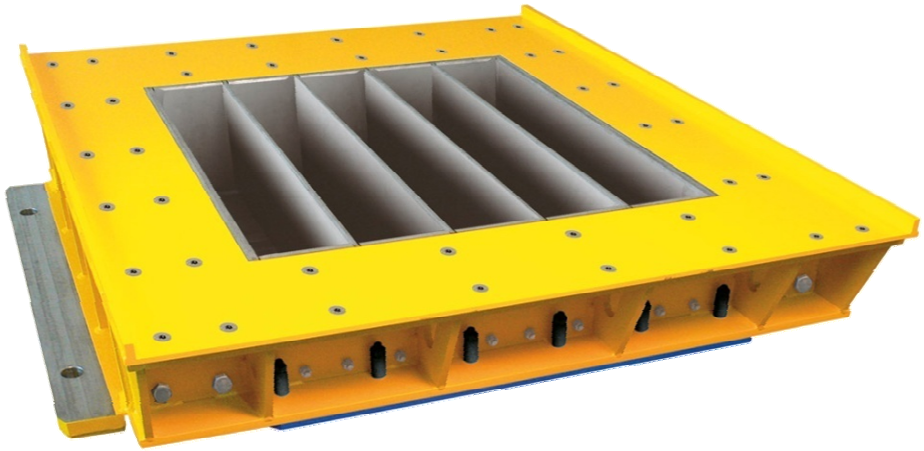
In the forward looking traditions of a family enterprise, 600 highly qualified associates around the globe are producing molds of first class quality and the highest dependability.

Satisfied clients around the globe have, for decades, been living proof of the quality and scope of Rampf's relationship with the Concrete Industry.

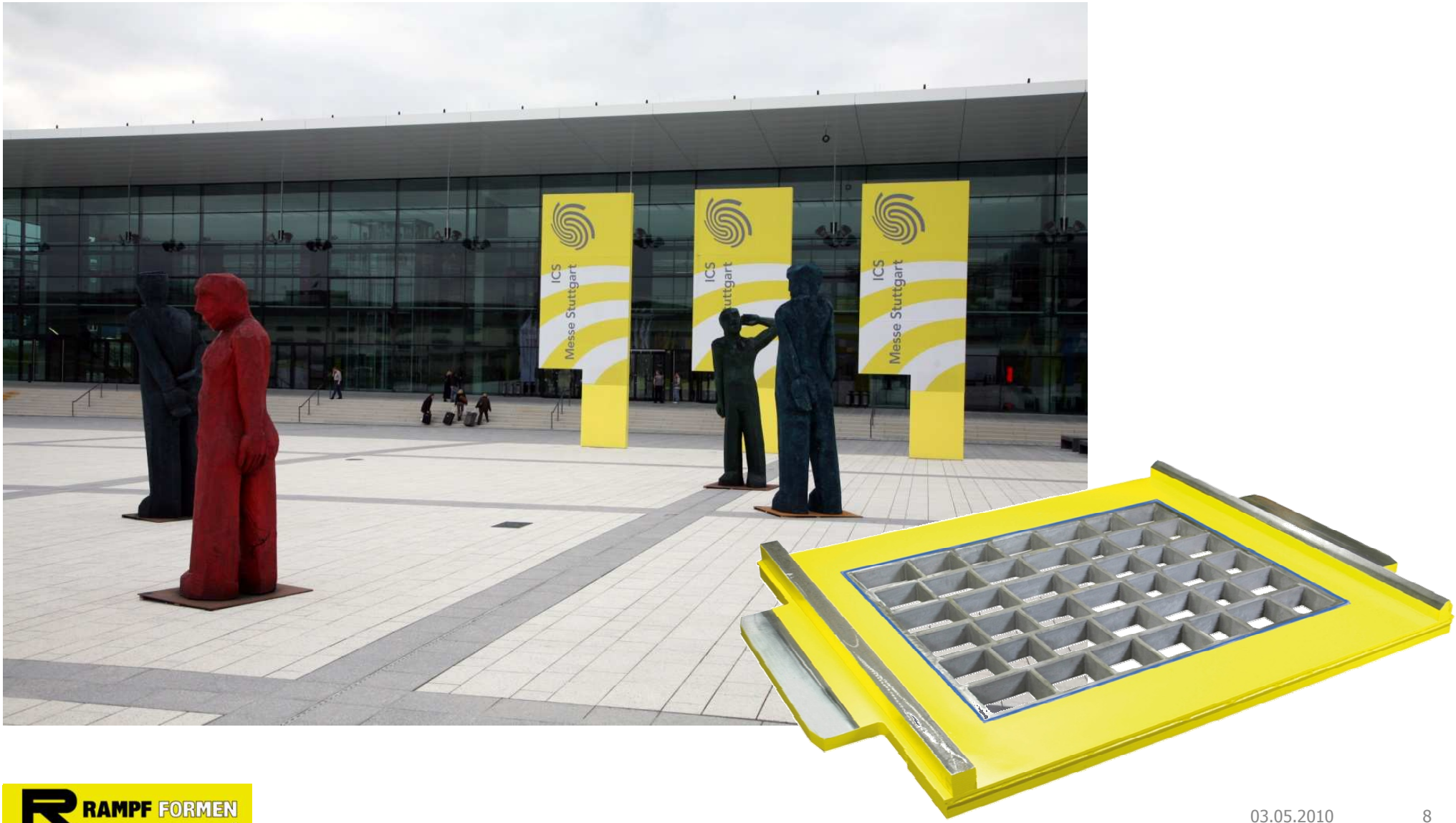
RAMPF FORMEN today

RAMPF SUBSIDIARIES

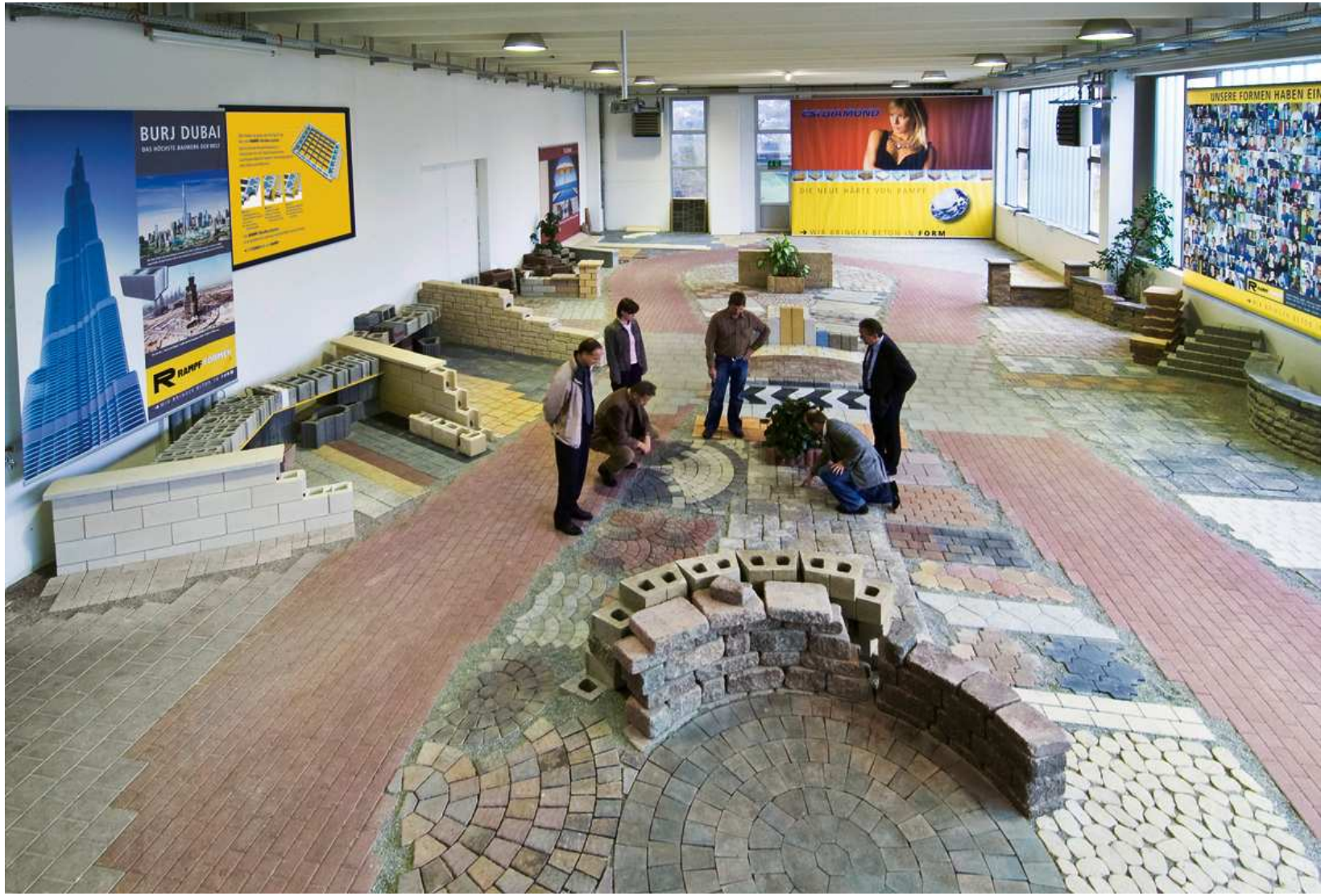
Mould for Kerbs



Molds for Pavestones



„Stone-Hall“

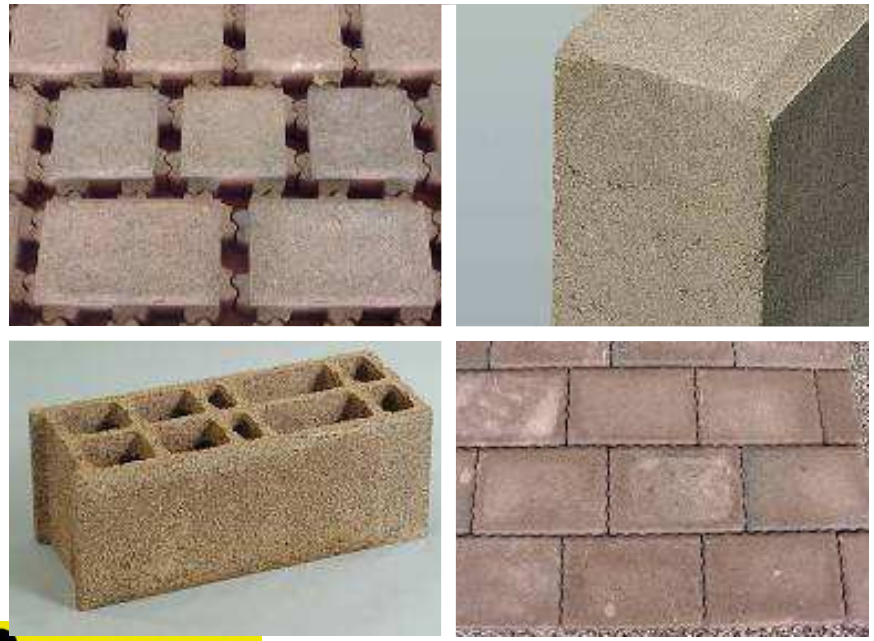


The field of application in Dubai

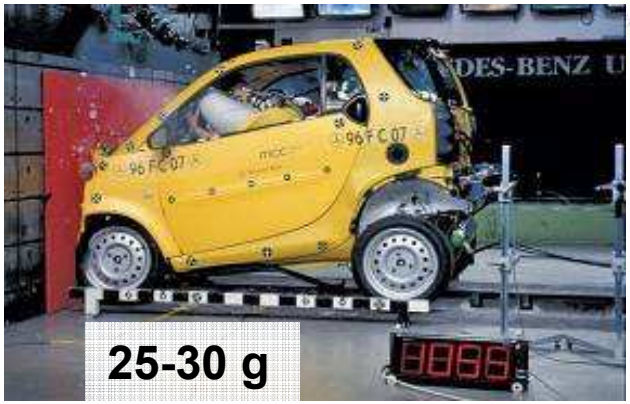
Sheik Zayed Road with Emirates Towers, Dubai

Production System

- Cycle times in manufacturing (max. 12-20s duration per step)

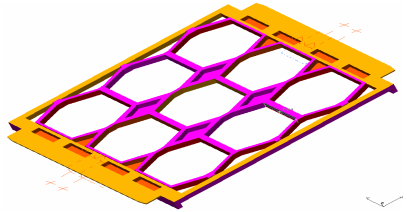


Acceleration, Vibration



How should the mold look like the future

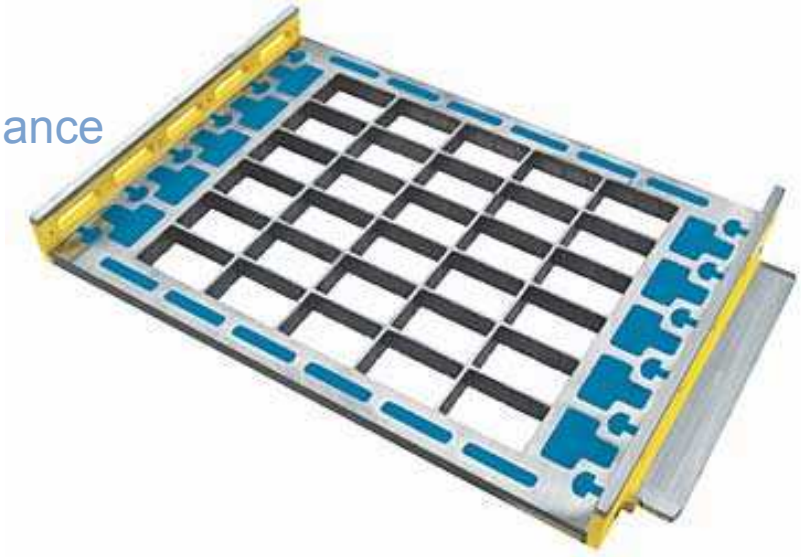
It recognizes itself!
RFID technology!



Best material,
optimized in **Structural mechanics**

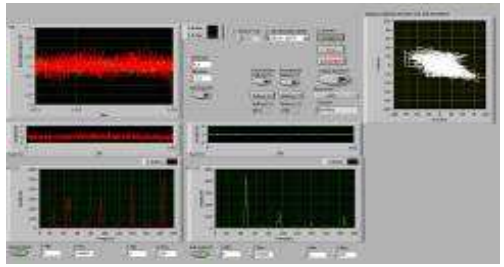
Energy harvester
supports WSNs

Predictive maintenance

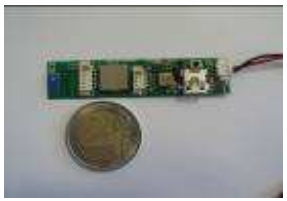


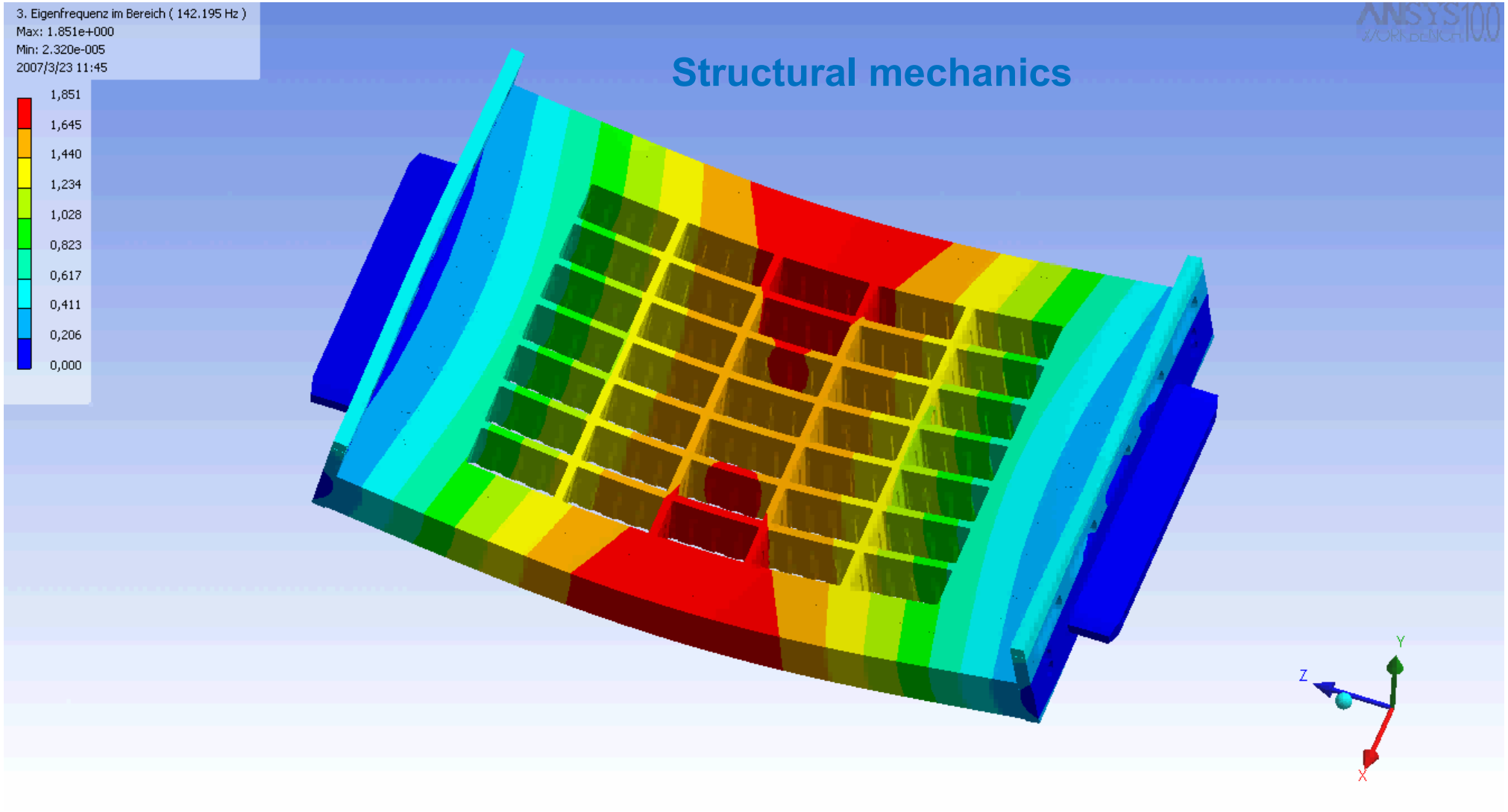
WSNs for more
process parameters

The mold optimizes
energy efficiency and
concrete compression
automatically..

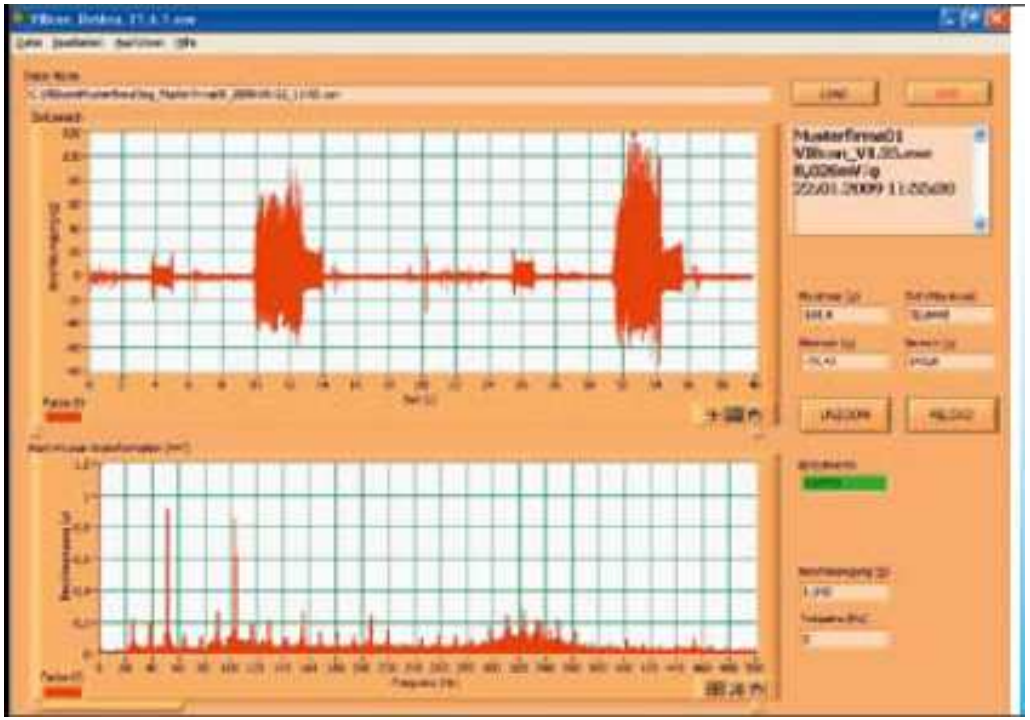


WSNs are outonomus
and invisible integrated




3. Eigenfrequenz im Bereich (142.195 Hz)
Max: 1.851e+000
Min: 2.320e-005
2007/3/23 11:45
1,851
1,645
1,440
1,234
1,028
0,823
0,617
0,411
0,206
0,000
Structural mechanics
ANSYS 10.0 WORKBENCH
Y
Z
X

Structural mechanics



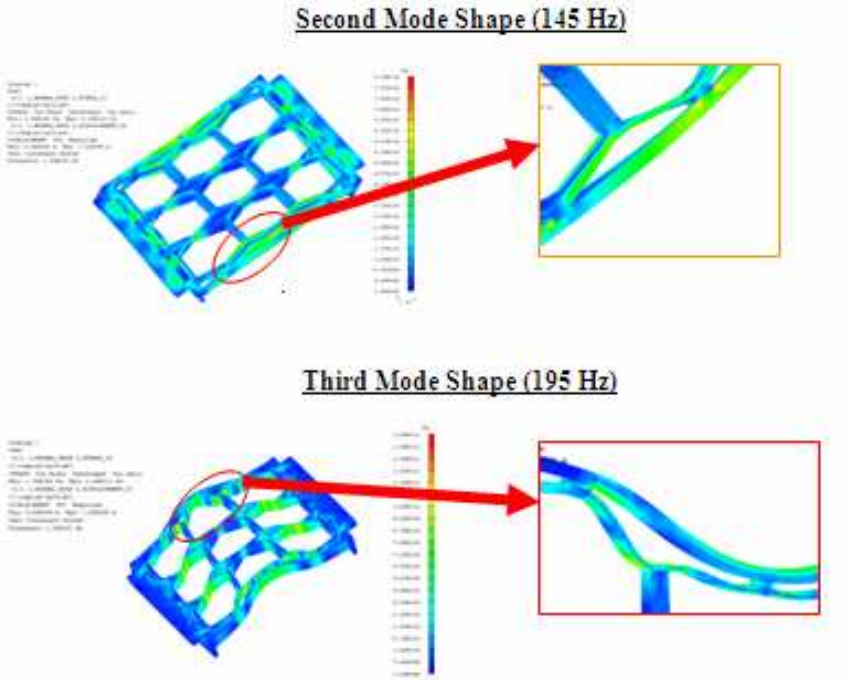
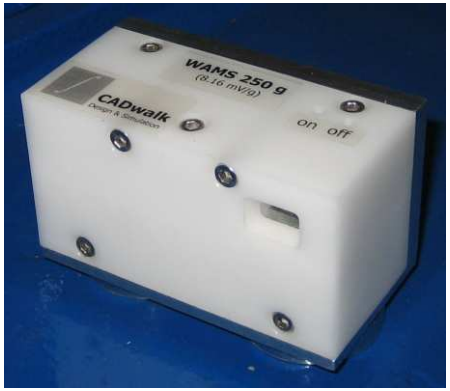


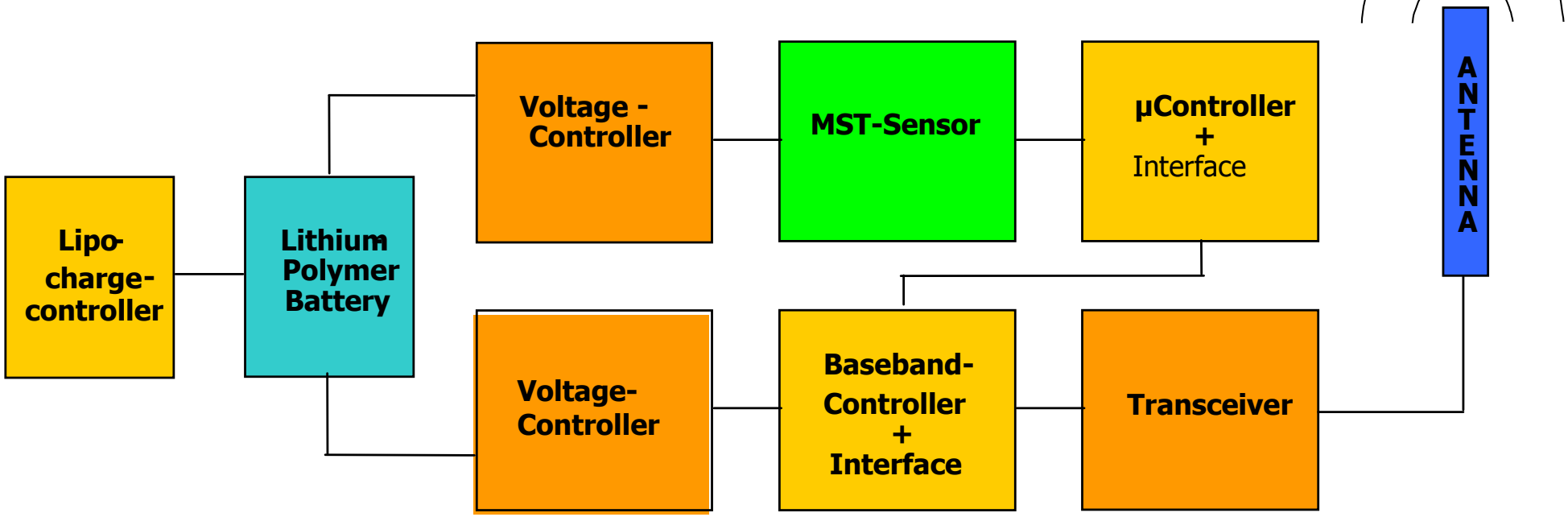
Figure 7. Details of maximum Von Mises stresses in modal response for Configuration II without side rails for $E_p = 0.1\ E_{steel}$.

Wireless Sensor Notes



Vibrations on the track

VIBcon, a sensor node designed for real time visualisation and recording vibration data on moving machine parts



MST-Sensoren zur Schwingungsmessung

Dr.-Ing. Jiri Marek, Dr.-Ing. Michael Offenberg und Dr.-Ing. Frank Melzer

(Robert Bosch GmbH/Bosch Sensortec)

DEUTSCHER ZUKUNFTSPREIS
Preis des Bundespräsidenten für Technik und Innovation

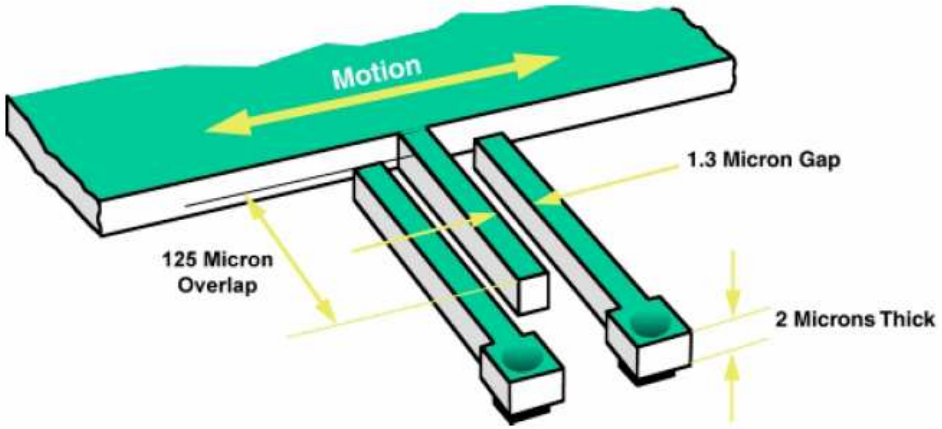


Figure 1. Beam Dimensions for a Single Finger.

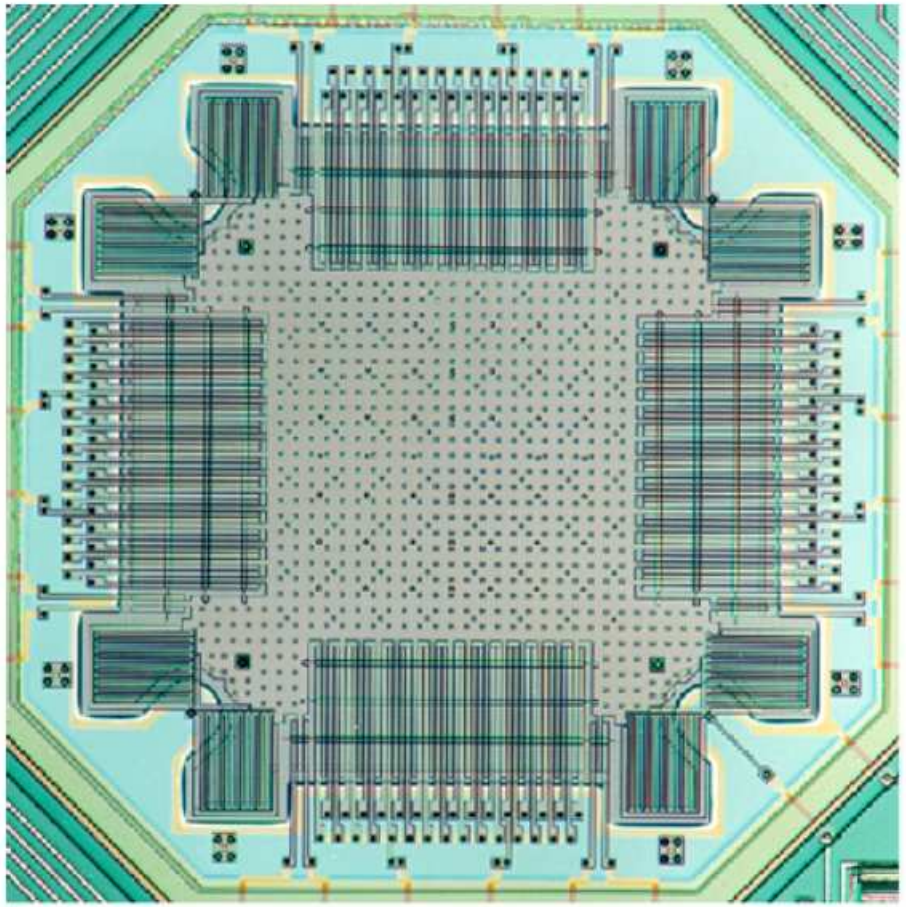
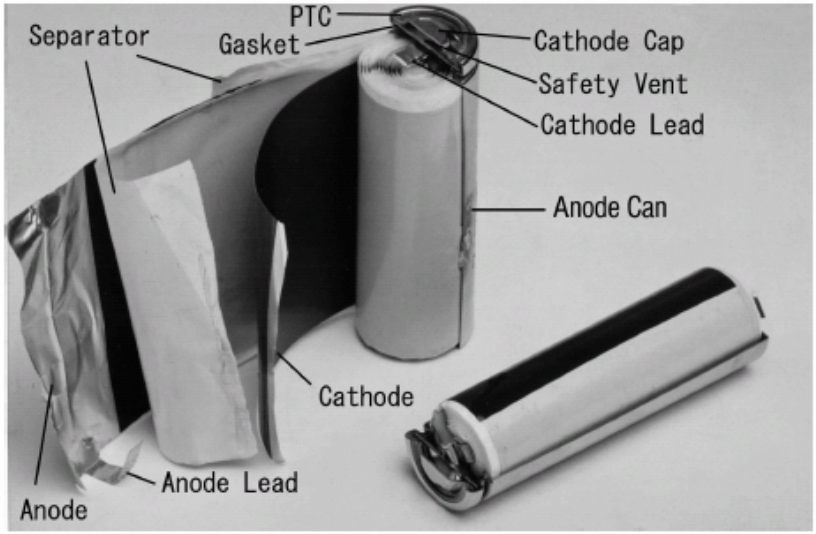
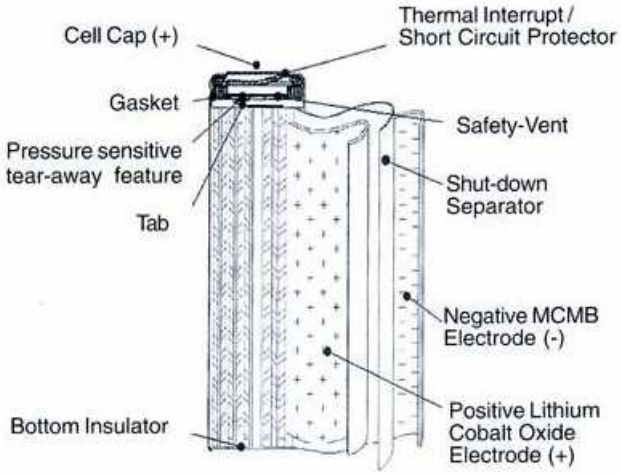
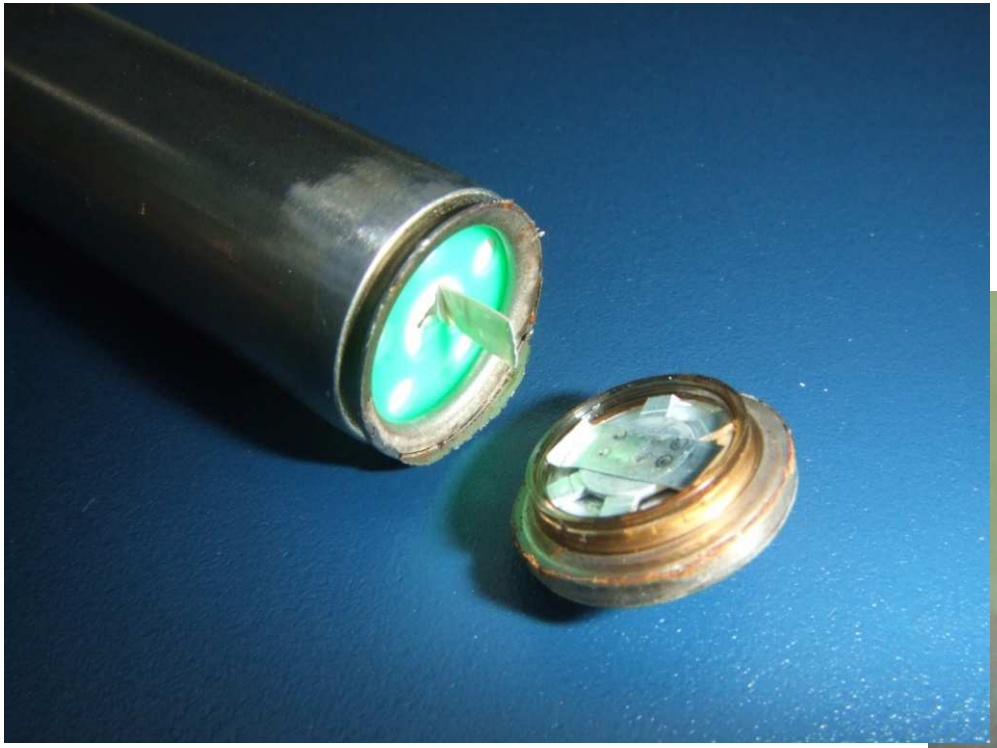


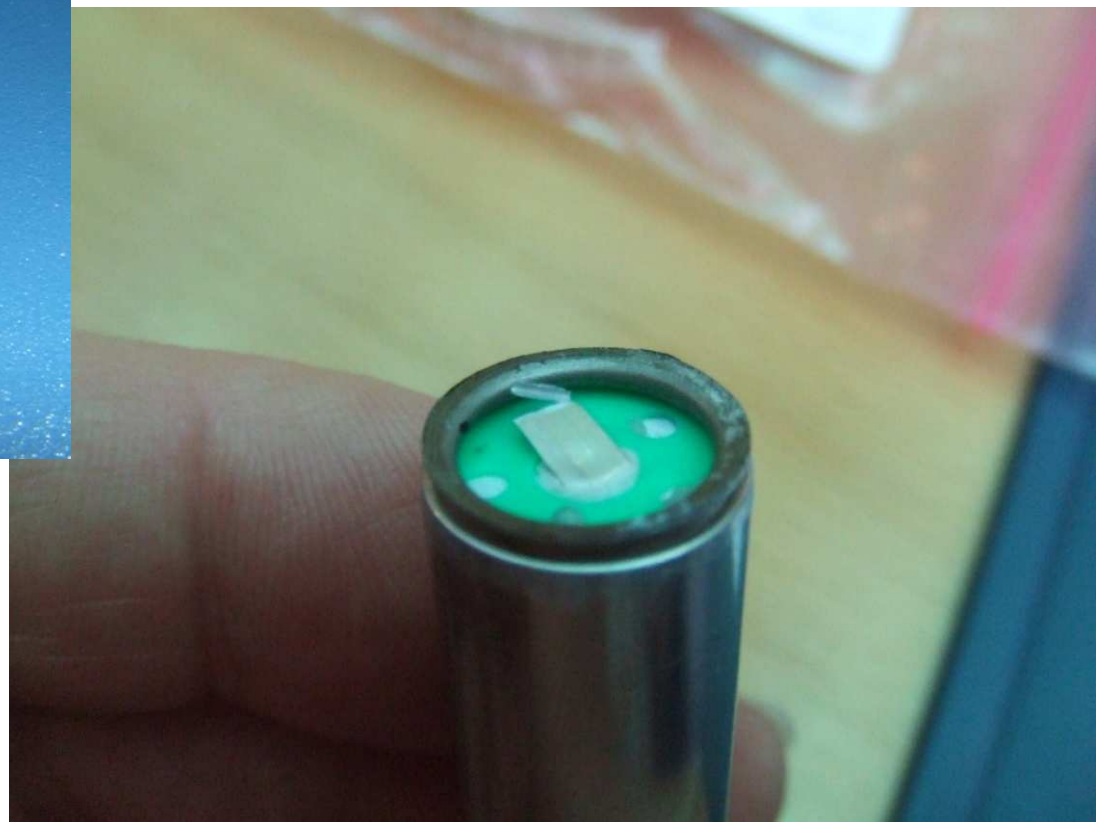
Figure 2. ADXL202 Beam Structure.


Separator
PTC
Gasket
Cathode Cap
Safety Vent
Cathode Lead
Anode Can
Cathode
Anode Lead
Anode


Cell Cap (+)
Thermal Interrupt / Short Circuit Protector
Gasket
Safety-Vent
Pressure sensitive tear-away feature
Shut-down Separator
Tab
Negative MCMB Electrode (-)
Positive Lithium Cobalt Oxide Electrode (+)
Bottom Insulator

A kind of Burn-In-Test for Lithium-Ion-Batteries





Energy Harvesting

The four main varieties in the litrature are:

- Thermal energy scavengers using e.g. thermo-electrics
- Vibrational energy scavengers, usually using electro-magnetic or piezo-electric generators
- Optical energy scavengers unsing solar cells
- Radio-frequency energy scavengers using antennae

Polymer Power: Dielectric Elastomers and Their Applications in Distributed Actuation and Power Generation

Proceedings of ISSS 2005
International Conference on Smart
Materials Structures and Systems
July 28-30, 2005, Bangalore, India

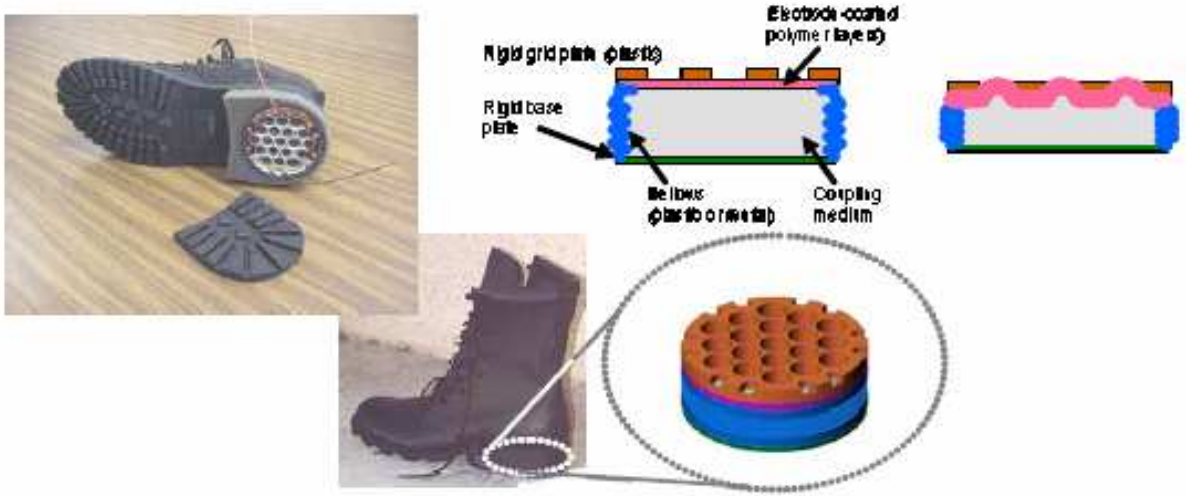
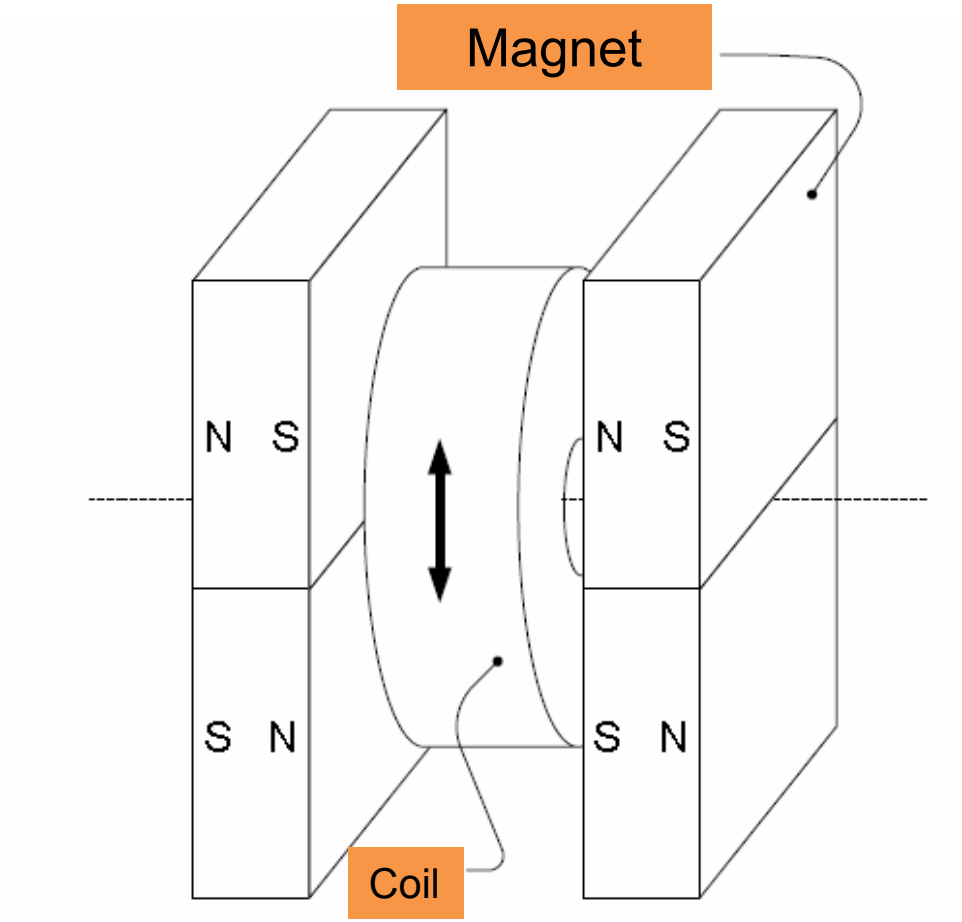


Figure 4. Dielectric elastomer-powered boot generators.

Harsha Prahlad,* Roy Kornbluh, Ron Pelrine, Scott Stanford,
Joseph Eckerle, Seajin Oh
SRI International, 333 Ravenswood Avenue, Menlo Park, CA, USA

A heel strike boot generator developed by SRI (Fig. 4) investigated ways to harvest otherwise wasted energy from walking[9]. The demonstrated recovered energy on the order of 1 W per boot can be used to supplement battery power charge small devices such as handhelds or cell phones, as an emergency backup source of power, for specialized onboard boot functions such as massaging or, in the future, to enhance walking and other mobility performance.

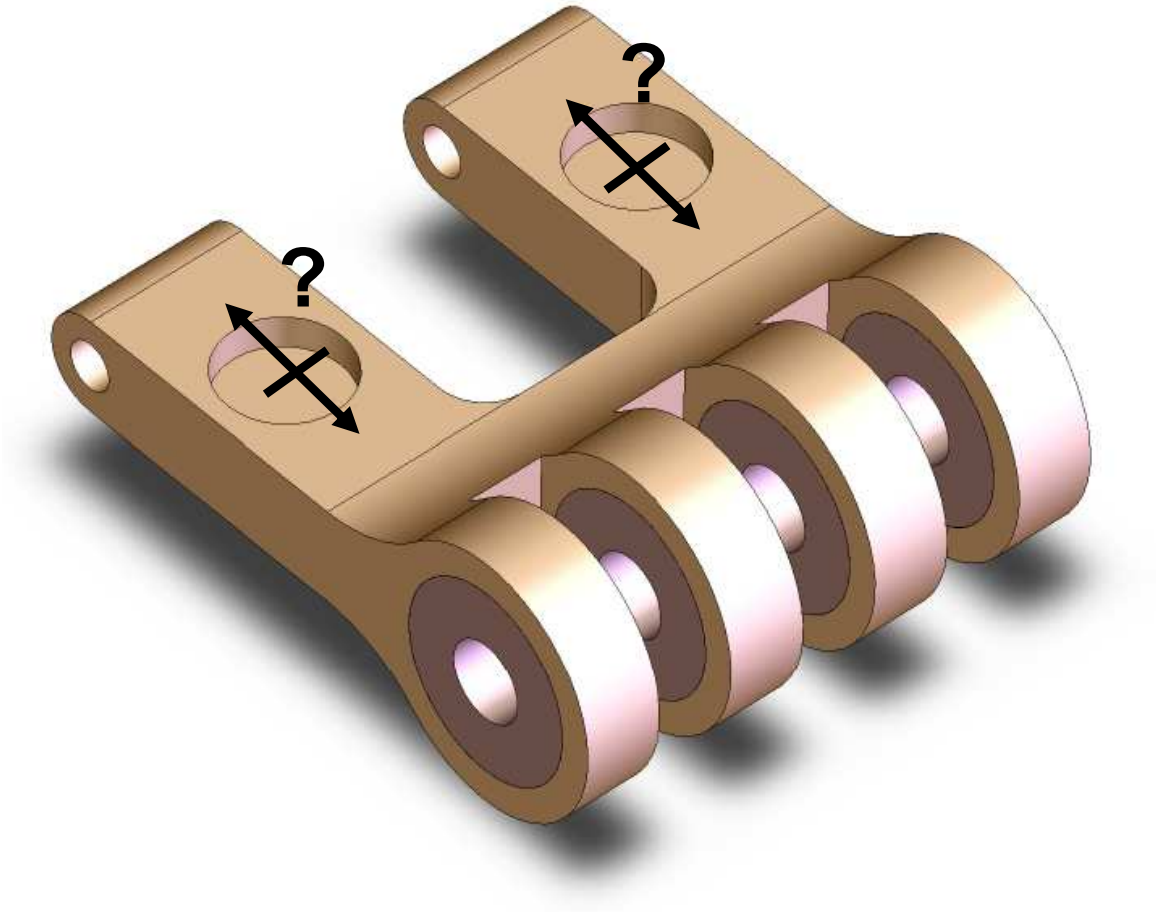
First Idea



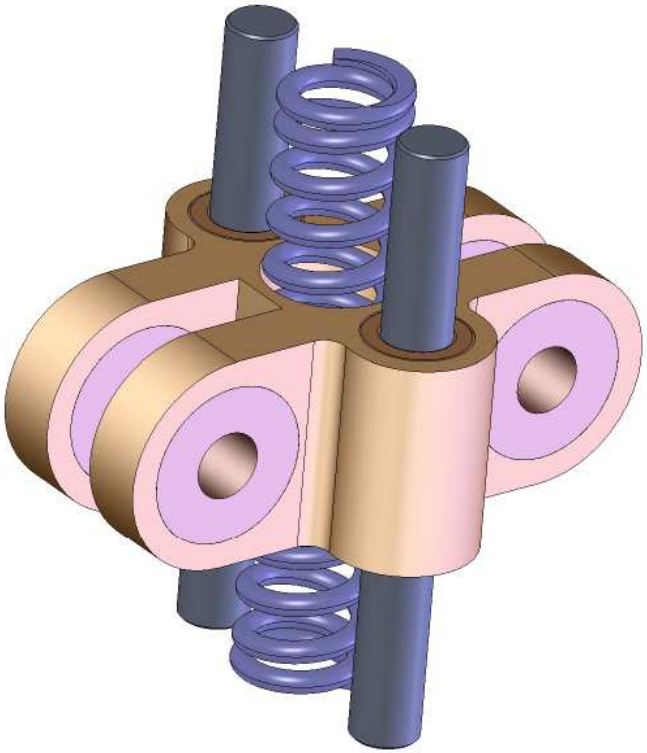
Construction Space 1 cm3:

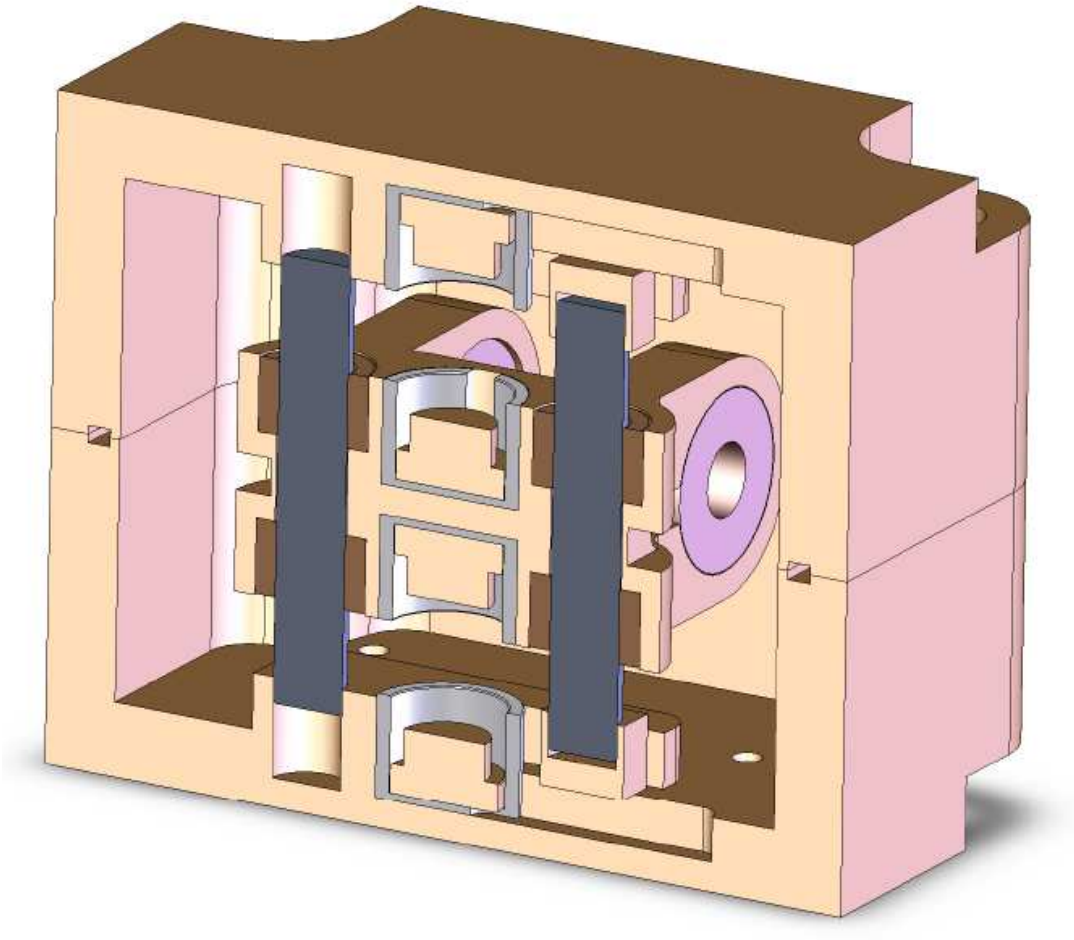
- a=8,7mm
- b=8,7mm
- h=13,1mm

1. Principle of a moving coil for a Kinetic-Energy-Converter

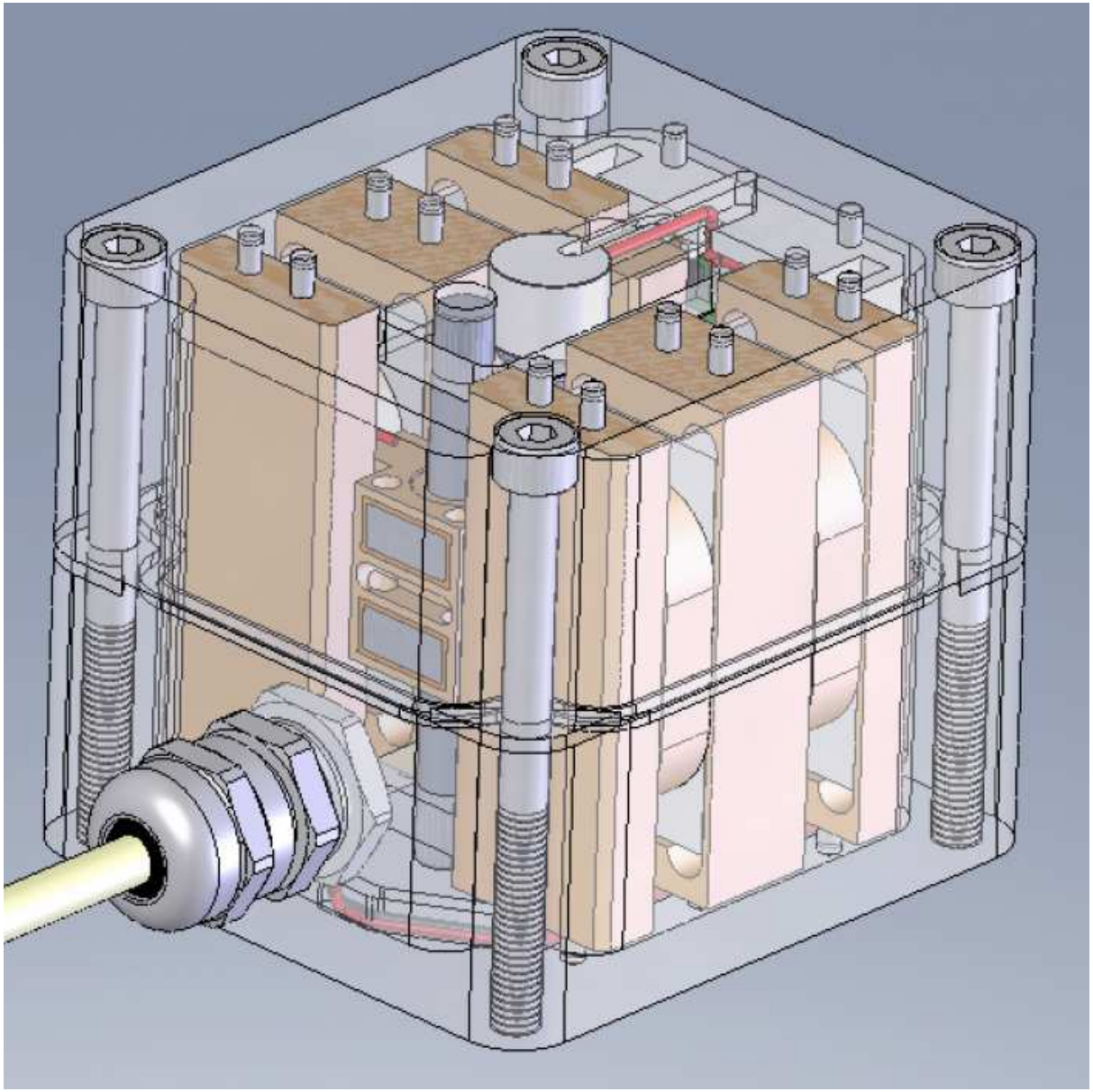


2. Principle of a Kinetic-Energy-Converter





Kinetic-Energy-Converter



Coils of the Kinetic-Energy-Converter

Harvester Design @ HSG-IMIT

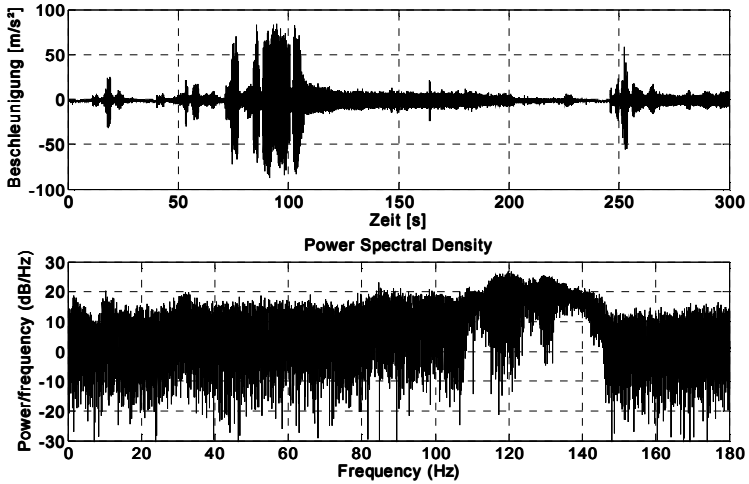
Place of Installation / Requirements
- Acoustic Measurements
- Data-Analysis

Selection of a suitable Working Principle
piezo-electric, inductive, capacitive, …

Generator-Modeling based on recorded excit. data
Analytic & System Simulation
Finite Elements Simulation

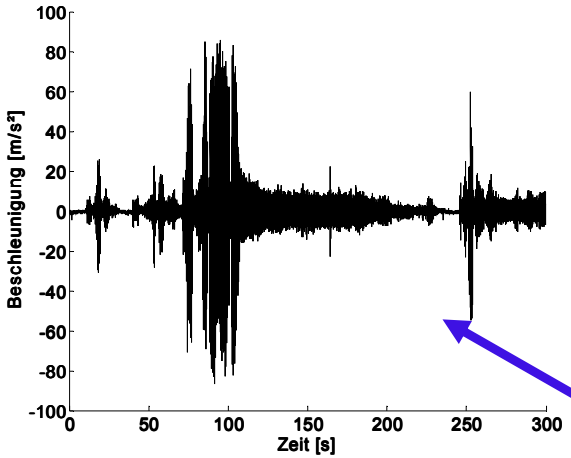
Prototyping
Machine Shop
Clean Room
Support by Local Partners

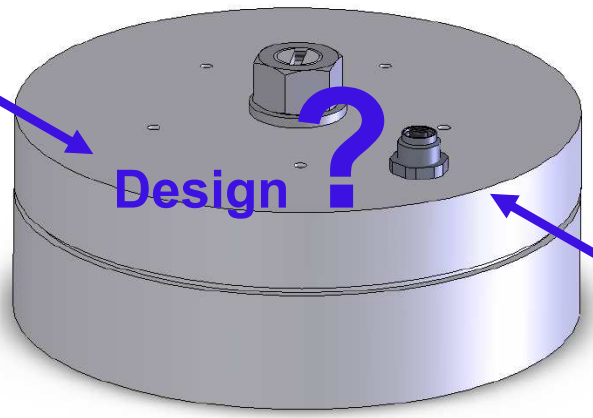
Testing
Laboratory Test (g-Lab)
Field Tests



CADwalk Design & Simulation

Harvester Design @ HSG-IMIT



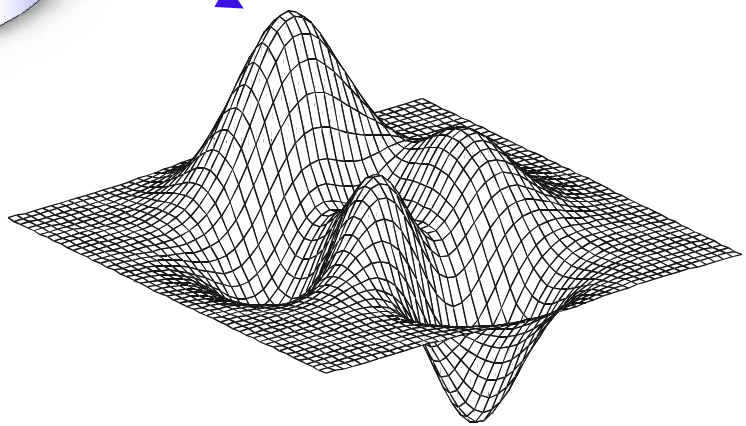


wanted:

- Operation Priciple
- Optimum Design
  - Material
  - Magnet/Coil Configuration
  - Shape …..

Application:

- Vibration Profile
- Shape / Size / Mass
- Required Power/ Voltage
- …



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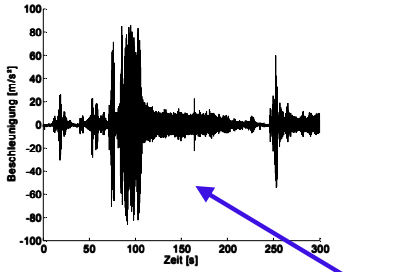
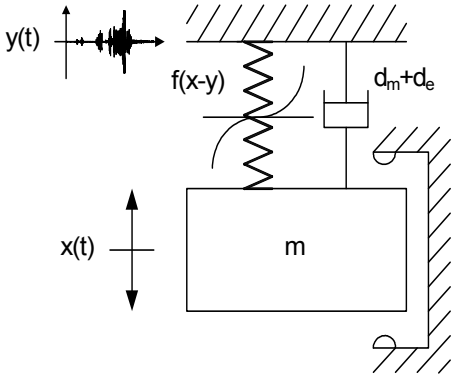
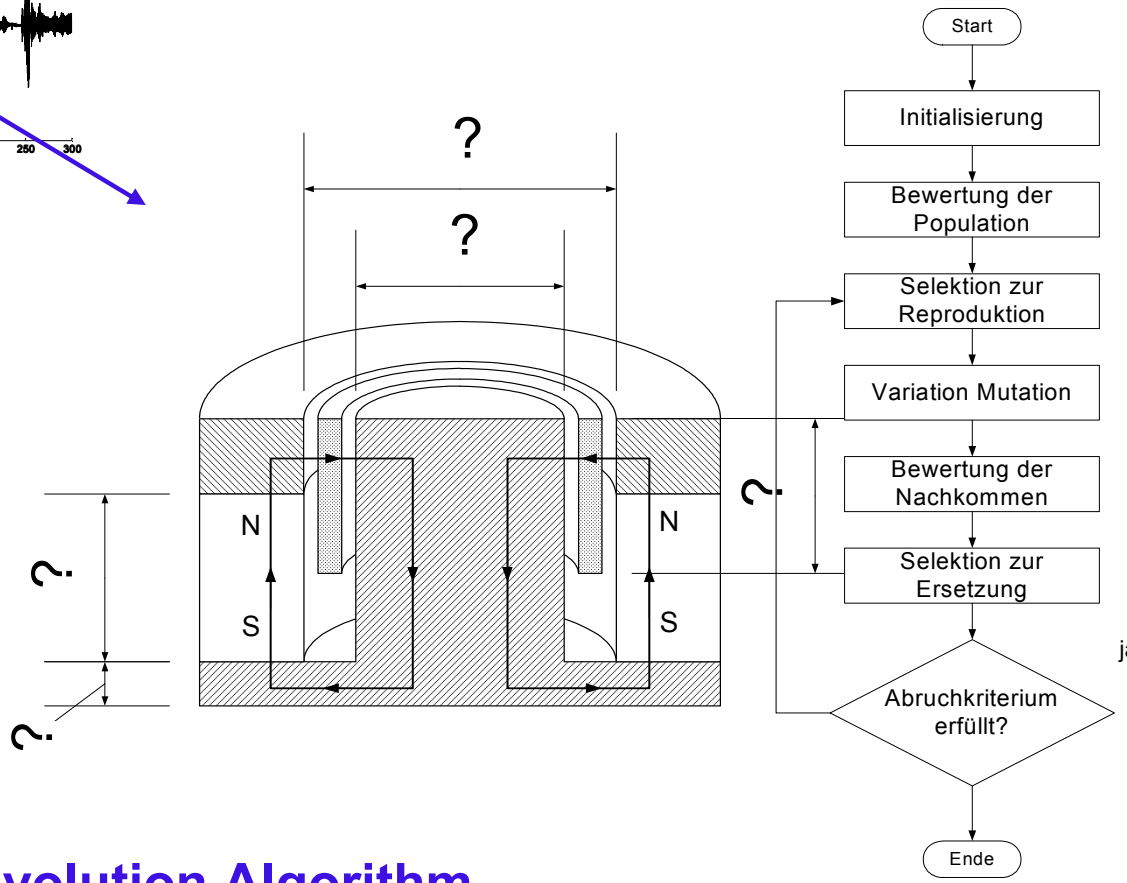
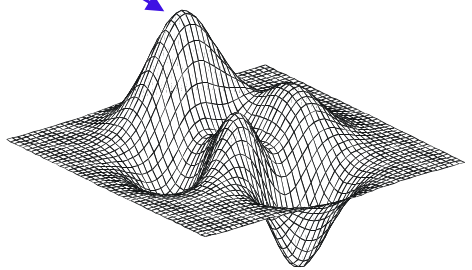
Harvester Design Optimization





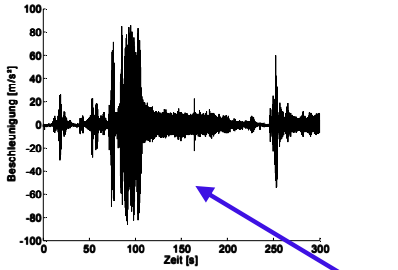


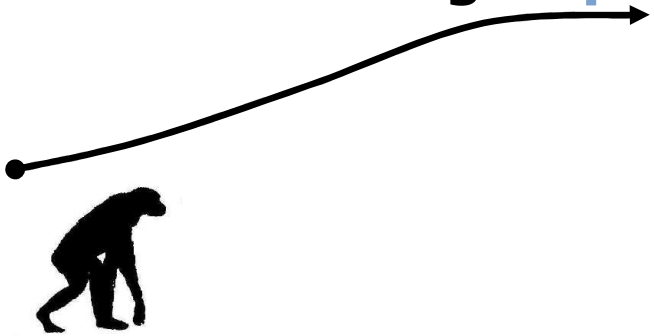


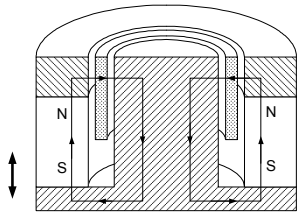
Evolution Algorithm

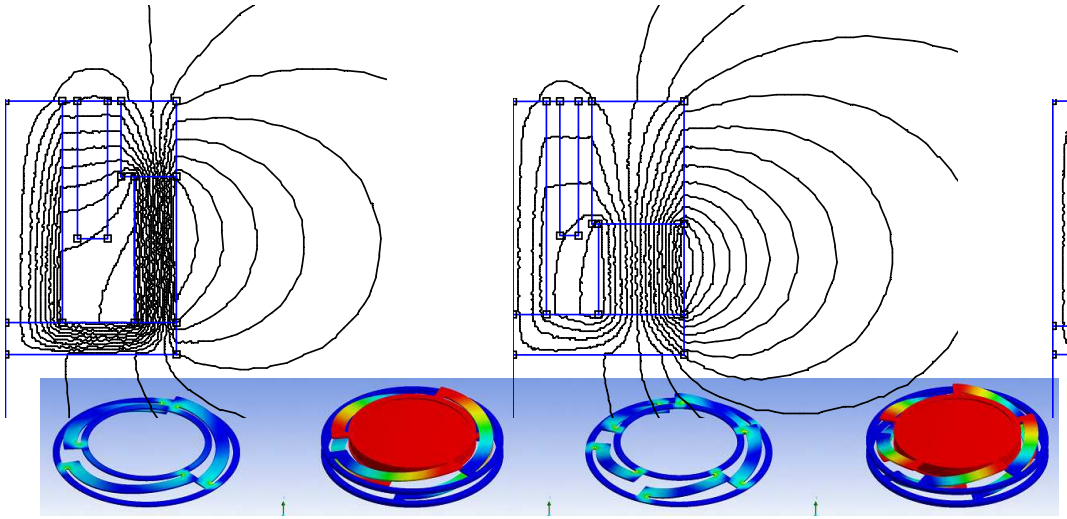
CADwalk Design & Simulation

Harvester Design Optimization









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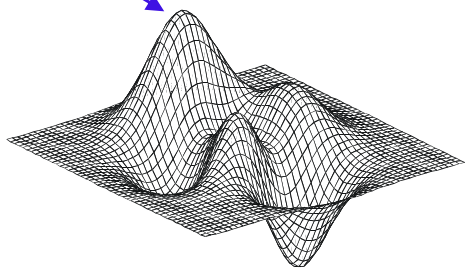
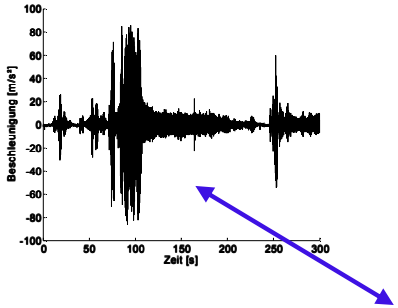
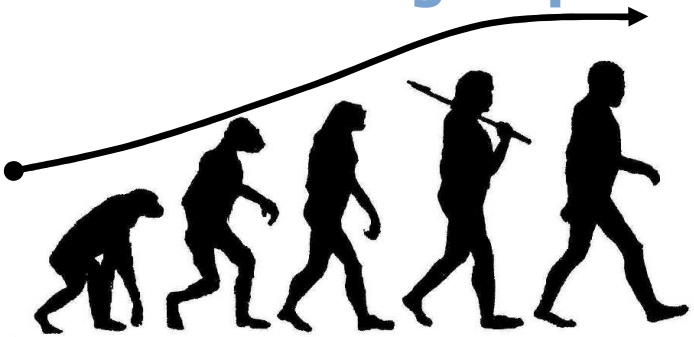
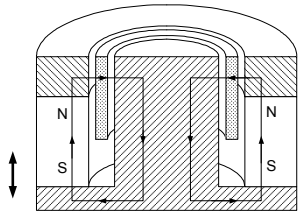


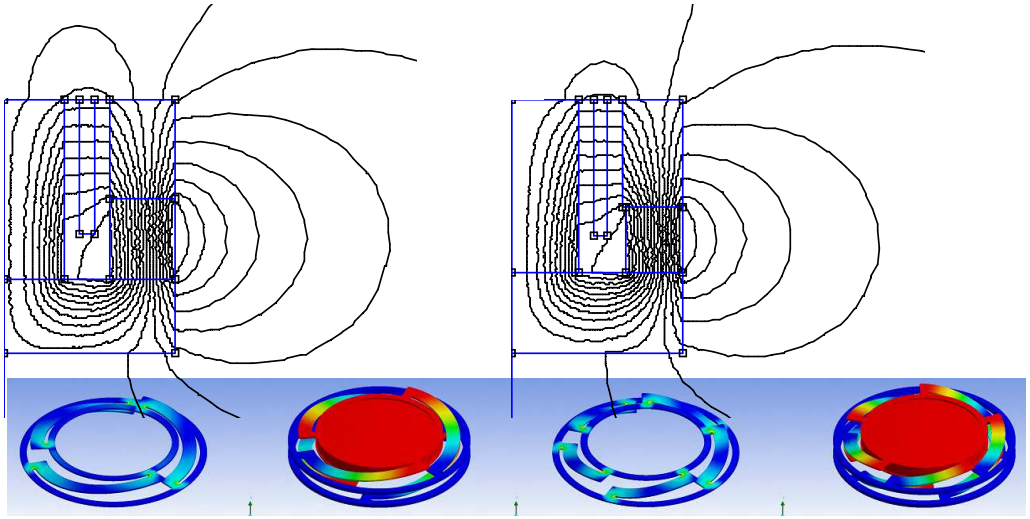
CADwalk Design & Simulation

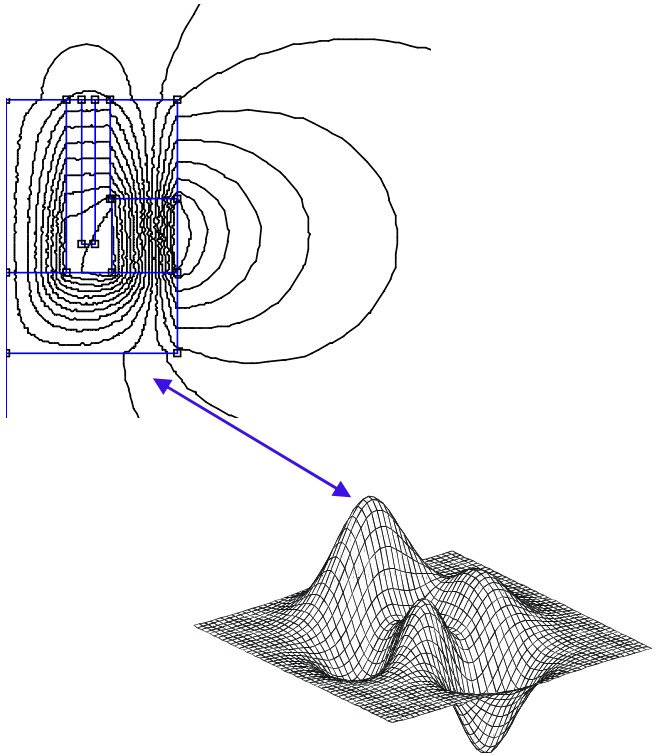
Harvester Design Optimization







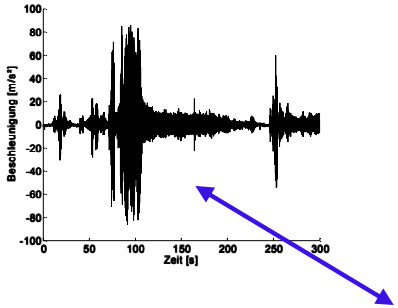




Evolution Algorithm

CADwalk Design & Simulation

Harvester Design Optimization



wanted:

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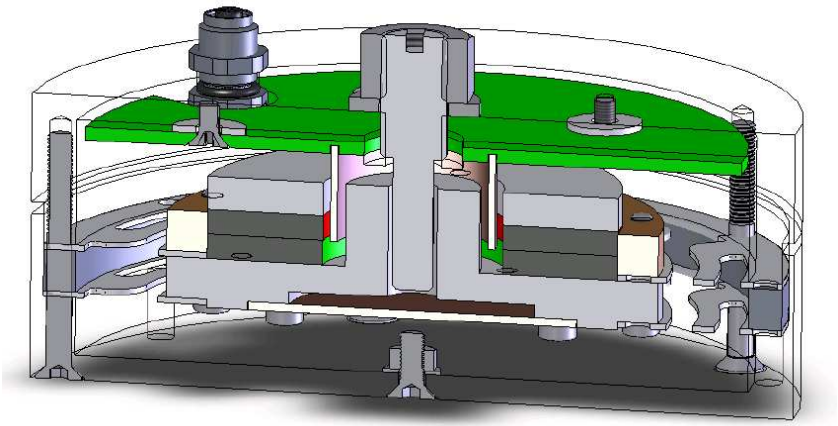

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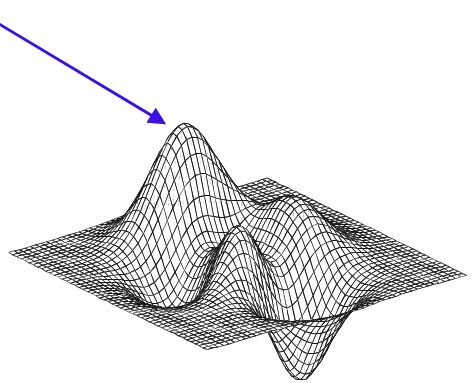

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Harvester Design & Transceiver today

Well testet in a Vibration-Range of > 200 g

Result today:

> 6 Vss

> 3 V_{DC}

>120 mW

Future Applications