TECHNISCHE UNIVERSITÄT DRESDEN

Fakultät Maschinenwesen Institut für Halbleiter und Mikrosystme, Professur für Mikrosystme

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Topic for student research / diploma / master project

Design of self-priming circuits for dielectric elastomer energy-harvesters

Flexible dielectric elastomers offer great potential not only as soft capacitive sensors but also as energy harvesters, thanks to their ability to convert mechanical deformation into electrical energy. Embedding dielectric elastomer-based capacitive sensors into machine elements, such as elastomer couplings, enables condition monitoring and self-powered sensing. In this context, an efficient self-priming circuit is crucial for sustaining the necessary bias voltage for harvesting while enabling seamless switching between sensing and energy harvesting modes.

This work will focus on designing a self-priming circuit suitable for dielectric elastomer energy harvesters integrated within elastomer couplings that contain multiple capacitive sensors. The sensors shall be operated in a dual mode, switching between their roles as sensors and as energy harvesters. The challenges include designing circuits with varying capacitance, ensuring sufficient voltage priming, and implementing robust switching logic for mode transitions.

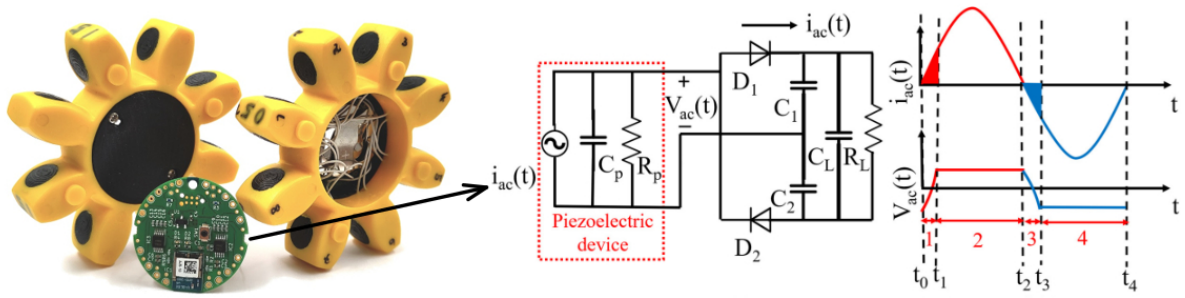

Figure: Sensor-integrating coupling with measuring electronics, enabling the implementation of a self-priming energy harvesting circuit

Focus of work

- Literature review on dielectric elastomer energy harvesters and self-priming circuits
- Analysis of requirements for integrating energy harvesting and sensing in sensorized machine elements
- Design of a suitable self-priming circuit including switching strategies
- Implementation of a basic experimental demonstrator
- Experimental investigations of the designed circuit with the elastomer sensors
- Documentation and discussion of results

Counterpart

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