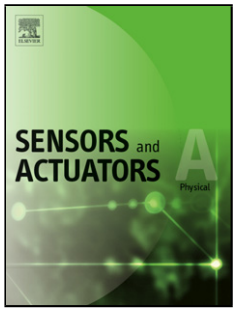

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A Flexible Tube-Based Triboelectric- Electromagnetic Sensor for Knee Rehabilitation Assessment

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Abstract

This paper reports a novel hybridized flexible electromagnetic-triboelectric generator for vibration/deflection monitoring as it is implemented in a cantilever or clamped-clamped configuration.The proposed self-powered sensor operates based on the concepts of electromagnetism and triboelectricity. The fabricated device consists of a stack of magnets and coils, a flexible tube as the main body, and also, highly flexible, mechanically and thermally durable, and cost-effective polymeric materials.The configuration of the electromagnetic component is optimized based on the magnetization direction of the utilized magnets. The device can effectively convert the shear force and bending moment to electrical voltage through the hybridized system with exerting an external force. The performance of the self-powered sensor is investigated for different cases including a single stack and also a double stack of magnetic components. The design of the triboelectric component of the device is based on the vertical contact separation mode. Results of the paper show how the change of configuration of the magnetic components alters the electrical output of the sensor. A detailed experimental analysis is provided to show the capability of the device under different excitation conditions for both TENG and EMG components of the sensor.As the experimental analysis shows, the proposed self-powered system has the potential to be utilized for knee rehabilitation, as it shows explicit results under periodical bending load with different frequencies and amplitudes of excitation.

Keywords: Hybridized nano generator, Electromagnetism, Triboelectricity, Self-powered sensor, Knee rehabilitation.

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