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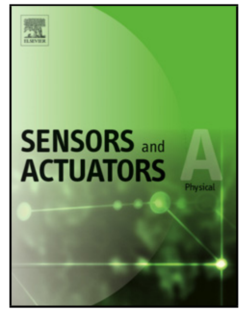

Title: A digitally adjustable sensor signal conditioning circuit for low frequency operation

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A digitally adjustable sensor signal conditioning circuit for low frequency operation

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Highlights

- A general purpose signal conditioning circuit with full digital control is presented.
- The gain coefficients and the offset levels of the circuit can be digitally adjusted.
- A prototype circuit is assessed with reference and real-life sensor signals.
- The circuit is demonstrated to select small parameter changes from the input signal.

Abstract.

A fully digitally adjustable sensor signal conditioning circuit (SCC) is proposed herein. The SCC is meant to properly adjust the input signal delivered either by active sensors or by passive sensors (e.g. thermocouples, piezoelectric and/or pyroelectric sensors, etc.). The circuit is meant to be resistively connected to the sensor that delivers a signal containing low frequency components, ranging from direct current (DC) to $2*10^3$ Hz. The signal conditioning circuit is mainly based on one or two inverting stages, each provided with the possibility to digitally control both the gain coefficient (GC) and the direct current (DC) offset. The GC of each stage can be adjusted in a range spanning from sub-unitary to supra-unitary values, therefore the signal conditioning circuit can be used to preserve the dynamic range of an analog to digital converter (ADC) in an optimum domain, while avoiding saturation, also when the input signal is within the dynamic range of the SCC's input but out of the dynamic range necessary at output. The circuit is designed to detain a low-pass characteristic, thus eliminating high frequency components; therefore it provides a basic bandwidth control. A digital to analog conversion stage is employed to adjust the DC offset and to run self-calibration and self- test procedures. The proposed circuit is meant as a basic building block, employed to interface a wide range of sensor signals in order to provide optimal levels for the ADC stage, or to be inserted in an analog signal chain, where signal level conversion may be achieved (for example signal expansion or compression from 0- 5V voltage levels to 0- 3.3V levels). Alternatively, the proposed SCC could be inserted into more specialized data acquisition systems providing a digital system with the ability to