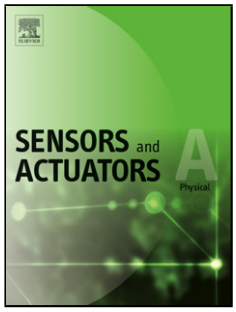

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Online Auto-calibration of Triaxial Accelerometer with Time-variant Model Structures

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Abstract

In this paper, an online auto-calibration method for MicroElectroMechanical Systems (MEMS) triaxial accelerometer (TA) is proposed, which can simultaneously identify the time-dependent model structure and its parameters during the changes of the operating environment. Firstly, the model as well as its associated cost function is linearized by a new proposed linearization approach. Then, exploiting an online sparse recursive least square (SPARLS) estimation, the unknown parameters are identified. In particular, the online sparse recursive method is based on an $\mathcal{L}_1$-norm penalized expectation-maximum (EM) algorithm, which can amend the model automatically by penalizing the insignificant parameters to zero. Furthermore, this method can reduce computational complexity and be implemented in a low-cost Micro-Controller-Unit (MCU). Based on the numerical analysis, it can be concluded that the proposed recursive algorithm can calculate the unknown parameters reliably and accurately for most MEMS triaxial accelerometers available in the market. Additionally, this method is experimentally validated by comparing the output estimations before and after calibration under various scenarios, which further confirms its feasibility and effectiveness for online TA calibration.

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