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Design of a RISC Processor-Based Data Acquisition System for a 3D Vibration Analyzer

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[Hoque, Mohammad Mominul](#)^a ; [Motakabber S.M.A.](#)^a ; [Islam, Md. Rafiqul](#)^a ; [Ihsan, Sany](#)^b

^aInternational Islamic University Malaysia-IIUM, Department of Electrical and Computer Engineering, Malaysia

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Abstract

This paper presents the design and implementation of a Reduced Instruction Set Computer (RISC) processor-based data acquisition system (DAS) tailored for a 3D vibration analyzer. The system integrates high-speed analog-to-digital conversion, real-time signal processing, and efficient data storage to monitor vibrations in three axes for industrial and structural health monitoring applications. A custom RISC processor optimizes computational efficiency and power consumption, enabling real-time analysis of vibration data. The system achieves a sampling rate of 10 kHz per axis with 16-bit resolution, ensuring high-fidelity data capture. Experimental results demonstrate the system's reliability in detecting vibrational anomalies, making it suitable for predictive maintenance and fault diagnosis. © 2025 IEEE.

Author keywords

3D Vibration Analyzer; Data Acquisition System; Embedded Systems; RISC Processor; Signal Processing

Indexed keywords

Engineering controlled terms

Computational efficiency; Data acquisition; Data handling; Digital storage; Energy efficiency; Predictive maintenance; Reduced instruction set computing; Vibration analysis; Vibration measurement

Engineering uncontrolled terms

3d vibration analyzer; Computer processors; Data acquisition system; Design and implementations; Embedded-system; High-speed analog; Reduced instruction set computer processor; Reduced instruction set computers; Signal-processing; Vibration analyzer

Engineering main heading

Embedded systems; Signal processing

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