A smart sensing system to analyze piping vibrations in industrial installations

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Abstract:
An important issue that deserves a special attention in almost all industrial installations is related with piping vibrations. This paper presents a measurement system that includes several measuring nodes to acquire vibration data from a set of locations of an industrial piping system. Each measuring node includes basically a tri-axial accelerometer, a vibration sensor, a temperature sensor, a microcontroller and a ZigBee wireless communication unit. Concerning the software component of the measurement system, a particular attention was dedicated to measurement accuracy and errors' compensation caused by influence variables. Artificial neural networks, namely Kohonen maps, are proposed to classify vibration patterns associated with the data collected from the distributed measurement network. A flow meter test bench was used to perform static and dynamic tests and to evaluate measurement system performance.

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I. Introduction

A common problem that can affect deeply the reliability of any industrial process is related with piping vibration. High vibration levels can cause multiple problems that include damage of expensive equipments, reduction of process yields and increment of maintenance activities, unplanned process downtime and injuries to working personnel, among others. According to recent studies, 20% of process pipe work failures are due to vibration-induced fatigue. Hence, vibration measurements are essential to evaluate the performance of industrial installations and to schedule corrective and predictive maintenance based on regular or continuous monitoring results that reveal changes in material properties with time due to fatigue loading.

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