PDF-Based Progressive Polynomial Calibration Method for Smart Sensors Linearization

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J. M. Dias Pereira ; Octavian Postolache ; P. M. B. Silva Girao All Authors

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Abstract:
Calibration and linearization are two important topics that must always be considered to assure the accuracy of measuring systems. Measurement errors, i.e., offset, gain, and linearization errors, can be compensated as long as timely calibration routines are performed in the measurement system. Nowadays, with the advent of smart sensors, the new capabilities associated with microprocessor or microcontroller devices can support new and advanced calibration and self-calibration algorithms that contribute to increase measurement accuracy. In this paper, an adaptive self-calibration algorithm for smart sensors linearization is proposed. The algorithm takes into consideration the probability density function of the measured data to reduce the number of calibration points, as well as the associated calibration time, for a required level of accuracy. The progressive polynomial interpolation method preserves the values of the calibration coefficients, which are already evaluated in previous calibration iterations, without starting the algorithmic calculation of a new set of the calibration coefficients for each new additional calibration point. Some simulation and experimental results for a square-root characteristic of a venturi-type airflow transducer will be presented to validate the theoretical expectations.

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Contents