INTERFACING ELECTRONIC FOR MEASUREMENT, SIGNAL PROCESSING AND WIRELESS COMMUNICATION

Edited by

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Chapter 30

SIMULATIONS OF RESISTANCE VARIATIONS TO PULSE GENERATOR CIRCUITS

ZEESHAN SHAHID, SHEROZ KHAN, AHM ZAHIRUL ALAM

In monitoring, automation and control, small resistive changes are needed to be reproduced as small signals emulating the physical parameter of our interest such as force, displacement, vibration, and temperature. Conversion of resistive changes into corresponding time period or frequency changes has been around for some time. Such conversions have been one of the most reliable and significant measurement steps in resistive transducers applications commonly used in today's industry. Their application is on the rise particularly in cases of automation and control being carried out wirelessly through small distances such as narrow gaps.

30.1. INTRODUCTION

Resistance to time (or frequency) converters are the kind of converters which are of critical importance in small measurements activities. These measurements have been traditionally carried out by transducers normally exhibiting linear precise responses in most of the cases but over a limited range. When carried out over a wide range, transducers usually start showing nonlinear responses which results in inaccuracies. Such inaccuracies were not considered noticeable when looked from the traditional transducers' view point, where even sizeable errors were overlooked. However, in today's smart applications the overlooked ignorable mismatches are considered unaffordable. Therefore, it is crucial to implement a circuit which would be able to produce a linear as well as highly sensitive output. Various papers have presented and have proposed converter circuit that can be implemented in the transducer to produces linear as well as highly sensitive output. Two main papers of interest are (Mochizuki & Watanabe, 1996) and (Kaliyugavaradan, 2000) presenting the circuit by implementing Wheatstone bridge as well as amplifier bridge. In these papers, the effect of offset error and its compensation is being discussed to show that linearity improves with offset compensation scheme. The first paper by (Mochizuki & Watanabe, 1996) implemented relaxation oscillator with the combination of the Wheatstone bridge resistor. Wheatstone is implemented due to its ability to detect small changes in terms of resistance deviations as compared to the early implementation of relaxation oscillator (Mochizuki & Watanabe, 1996). However, nonlinearity characteristic starts to appear when the period is amplified due to time-delay which is onward solved by using compensation techniques.

The second paper by (Kaliyugavaradan, 2000) proposed a refined version of the circuit which not only rule out the need for using compensation arrangement, but also provided grounded transducer. This paper will be an extended version of the existing works with the