

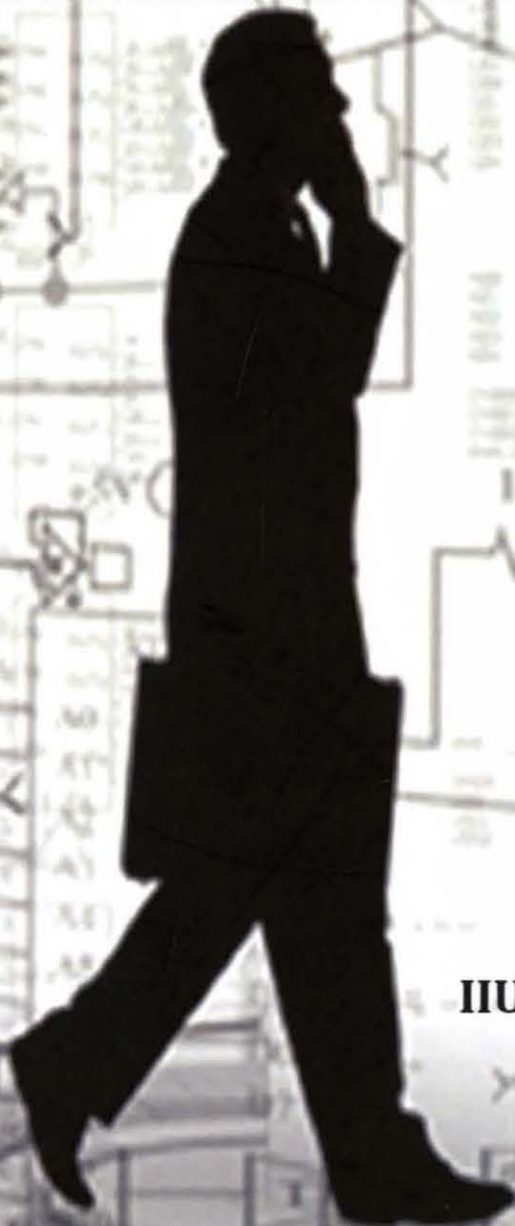
PRINCIPLES OF TRANSDUCER DEVICES AND COMPONENTS

Edited by

Sheroz Khan, International Islamic University Malaysia

Jalel Chebil, International Islamic University Malaysia

Othman O Khalifa, International Islamic University Malaysia



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EMAIL: iiumprinting@yahoo.com

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Chapter 19

SENSOR AND SENSOR RESPONSE-ISSUES AND INTERFACING

SYED MASRUR AHMMAD, SHEROZ KHAN, ANIS NURASHINKIN, MD RASIUDDIN KHAN

19.0 INTRODUCTION

The chapter presents the basic concepts of sensors and their response. Also the nonlinearity issues caused by the response are detailed with relative discussion and results. The errors obtained in the results are analysed as well.

19.1 TEMPERATURE SENSORS

A classical approach is to use a known resistance with a thermistor then excite it by a proper voltage source to make current flow through it which is linearly proportional to the temperature within a specified range of measurement. In a Wheatstone bridge, a thermistor is used instead of resistance and by three-point linearization technique, the output is linearized. The work reported by Hoge on the comparison of eight circuits for linearizing a thermistor output reveals that all (including five circuits containing operational amplifiers) are equal in linearizing capability.

One of the established techniques is using of different types of multivibrators. It is a three-point linear approximation. It involves contributing the second derivative of output voltage about the reference temperature to be zero and the contribution of the third derivative term is usually made negligible, it requires the basic assumption of a limited range of temperature for measurement.

A logarithmic amplifier or network is used to linearize the thermistor output. By using a logarithmic amplifier and an analog divider circuit, Chakravarty and Slater have achieved good results for a range of temperature from 0°C to 120°C by. Recently, Khan has achieved a good result with an error less than 0.9 percent by using a thermistor in a logarithmic network.

Finally, a relaxation oscillator is built by comparing outputs of an RC charging/discharging network and a resistive voltage divider (passive/active) circuit (which includes the thermistor), and using the compared output to trigger a timing network, which controls the RC charge/discharge circuit in a feedback closed loop configuration. In this regard, the work reported by Sundqvist is very significant, because the linearization technique does not theoretically involve any approximation.