ABSTRACT

Ideal transducers are considered to be linear. The output signal of such a transducer is linearly proportional to the value of the measured property. If the transducer is not ideal, numerous types of nonconformities can arise which moderate the transducer results inaccurate. But since in practice, there are some factors which bring non-linearity in a system. This research work focuses on the compensation of problems faced due to the non-linear response characteristics of different types of transducers.

A common solution for linearization is based on committed electronic circuits, whose transfer function is the inverse of the characteristic to be linearized. Even though this solution is extensively used in traditional instrumentation devices, the temperature drift of the electronic circuits and low flexibility associated with this solution limits the measurement system's performance and accuracy. Other well-known types of linearization solutions are based on look-up tables or piecewise linear interpolation. Look-up tables generally require a large memory space, and piecewise linear interpolation can originate large discontinuities in the linearized output signal if a reduced number of calibrations points is used.

Artificial neural network (ANN) based curve fitting techniques invite the measurement community to make use of them for linearization. Among software-based techniques recently proposed, not many of them are found to be simple in operation, yielding poor efficiency, and some of them are efficient in performance but suffer from the severe computational burden, which thereby leads to difficulties in implementation.

This dissertation focuses on the nonlinearity problem associated with transducers and suggests novel methods of circumventing these effects by suitably designing intelligent systems. In the present investigation, transducers
such as Capacitive Pressure Sensor (CPS), Linear Variable Displacement Transducer (LVDT), Thermocouple, Flow velocity sensor, Venturi flow sensor and Photo-electric displacement sensor are selected for adaptive linearization. The existing fixed type nonlinearity compensators are not to be effective for time-varying nonlinear devices. However, adaptive techniques using evolutionary optimized algorithms are better candidates for solving such problems. The overall system provides accurate measurement of the whole range.