

SENSOR LINEARIZATION FOR MEASUREMENT SYSTEM

Course Objective:

Expose students to understand the importance and different linearization techniques used in measurement systems. This course motivates the student to implement soft computing and optimisation algorithms to design robust linearizer for a measurement system.

Course Content:

Linearization Basics: Necessity and Scope, Conventional methods. Overview of analogous, digital and mixed approach, Signal conditioning and linearization. Nonlinearity estimation and compensation of signal conditioning circuits.

Sensor Linearization of different process variable: Thermistor linearization-survey and scope, thermocouple linearization, Linearization of different type of transducers as temperature, level, pressure, flow and piezoelectric transducers. Study of methods used in various transducer linearization. Advantages and trade-off.

Linearization Techniques using conventional approach: Analogous thermistor linearization techniques using multi-vibrator, logarithmic amplifier, pulse generator, Timer IC 555 circuits, Sigma delta modulator. Digital linearization using microcontroller and LUT. Numerical method technique as piecewise linearization, curve fitting methods as spline, Modified Progressive Polynomial.

Sensor Modelling/linearization using Soft computing approach: Overview of intelligent heuristic technique as ANN for linearization. Need of two stage linearization. Sensor modelling and linearization. Advantages of soft computing over conventional methods of linearization. ANN, Fuzzy, ANFIS for sensor linearization.

Optimization Techniques: Overview of different mathematical techniques of optimisation. Study of various optimization techniques- Particle swarm optimisation, Ant colony optimisation, Genetic algorithm, Colliding bodies optimisation for sensor linearization.

Course Outcomes:

Upon completing the course, the student should have understood

1. Need and importance of sensor linearization.
2. Conventional and soft computing techniques used in sensor linearization.
3. Sensor linearization techniques using different optimization algorithm

TEXT BOOKS/REFERENCES:

1. Design with operational amplifier and analog integrated circuits. By Sergio Franco ,3rd edition Mc Graw Hill Inc 2014.
2. Neural Networks: A Classroom Approach by Satish Kumar. Mc Graw Hill Education(India) Private Limited, New Delhi 110016.
3. Colliding bodies optimisation: Extension and applications by A kavch and V.R Mahdavi. Springer publishers. January 10,2015

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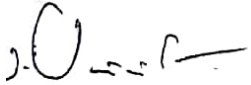
Sabyasachi Bandyopadhyay, Arnab Das, Anwesha Mukherjee ,Debangshu Dey, Member IEEE 'A Linearization scheme for thermistor based sensing in Biomedical Studies' IEEE Sensor Journal Vol 16 No 3 February 1, 2016.

Vaegae Naveen Kumar, Komanapalli Venkata Lakshmi Narayana , Annepu Bhujangarao and Samickannu Member IEEE 'Development of ANN based Linearization Technique for the VCO thermistor circuit' IEEE Sensor Journal Vol 15 February 2015.

Hamit Erdem 'Implementation of software based sensor linearization algorithms on low cost microcontroller' ISA Transactions 49 ,552-558,2010.

Zvezditz P.Nenova and Toshko G. Nenova, 'Linearization circuit for the thermistor connection' IEEE transactions on instrumentation and measurement Vol 58 No 2 February 2009.


D. Patranabis S Ghosh C Bakshi '*Linearizing transducer characteristics*' IEEE transactions on instrumentation and measurement Vol 37 No 1 March 1988.




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