A Neural Network Approach to Fluid Quantity Measurement in Dynamic Environments

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Springer

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ISBN 978-1-4471-4059-7 ISBN 978-1-4471-4060-3 (eBook)
DOI 10.1007/978-1-4471-4060-3
Springer London Heidelberg New York Dordrecht

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Control Number: 2012936111

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

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Acronyms

ANN	Artificial Neural Network
BP	Backpropagation Neural Network
DAQ	Data Acquisition
dB	Decibel (logarithmic unit)
DCT	Discrete Cosine Transform
DFT	Discrete Fourier Transform
DOE	Design of Experiments
DSP	Digital Signal Processing
DST	Discrete Sine Transform
DWT	Discrete Wavelet Transform
FFT	Fast Fourier Transform
FS	Fourier Series
FT	Fourier Transform
FTDNN	Focused Time-Delay Neural Network
FWT	Fast Wavelet Transform
IDCT	Inverse Discrete Cosine Transform
IFFT	Inverse Fast Fourier Transform
NARX	Nonlinear Autoregressive Network with Exogenous Inputs
NN	Neural Network
OEL	Occupational Exposure Limit
PCMCIA	Personal Computer Memory Card International Association
PLC	Programmable Logic Controller
RBF	Radial Basis Function
TDNN	Distributed Time-Delay Neural Network
WT	Wavelet Transform

Abstract

This book describes the research and development of a fluid level measurement system for dynamic environments. The measurement system is based on a single tube capacitive sensor. An Artificial Neural Network (ANN)-based signal characterization and processing system has been developed and used to compensate for the effects of sloshing, temperature variation, and the influence of contamination in fluid level measurement systems operating in dynamic environments, particularly automotive applications. It has been demonstrated that a simple backpropagation neural network coupled with a Moving Median filter could be used to achieve the high levels of accuracy required, for fluid level measurement in dynamic environments including those relating to automotive applications.