

# Condition Monitoring of Mechanical Systems with Incomplete Information

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A method for fault classification in mechanical systems in the presence of missing data entries is introduced. The method is based on autoassociative neural networks where the network is trained to recall the input data through some nonlinear neural network mapping. From the trained network an error equation with missing inputs as design variables is constructed. Genetic algorithm is used to solve for the missing input values. The proposed method is tested on a fault classification problem in a population of cylindrical shells. It is found that the proposed method is able to estimate single missing- entries to the accuracy of 93% and two missing- entries to the accuracy of 91%. The estimated values were then used in the classification of faults and the fault classification accuracy of 94% was observed for single-missing-entry cases and 91% for two missing- entry cases while the full database set is able to give classification accuracy of 96%.

## Brief Bibliography

Tshilidzi Marwala (born 1971) is the Chair of Systems Engineering at the University of the Witwatersrand, South Africa. He has won over 40 awards and is the youngest recipient of the highest national award given to a South African citizen, the Order of Mapungubwe, whose other recipients are Sydney Brenner and J.M. Coetzee. He holds a Bachelor of Science in Mechanical Engineering (Magna Cum Laude) from Case Western Reserve University, USA, Master of Engineering from the University of Pretoria, PhD in Engineering from University of Cambridge (St John's College) and attended a Program for Leadership Development at Harvard Business School. He was previously a post-doctoral research associate at the Imperial College of Science, Technology and Medicine, was a visiting fellow at Harvard University and worked as an executive at SABMiller in Johannesburg. He has published 2 books, edited a conference proceeding and published over 150 papers in journals, proceedings and book chapters, has supervised 30 master and PhD theses and has two patents. He was part of a team that succeeded in bringing the 2014 World Congress of Automatic Control to Africa for the first time. His work and opinions have appeared in many publications such as the New Scientist and Time Magazine. He is the associate editor of the International Journal of Systems Science, Journal of Computers, the ICIC Express Letters: An International Journal of Research and Surveys and the Open Aerospace Engineering Journal. He was the Chair of the Local Loop Unbundling Committee, is a Deputy Chair of the Limpopo Business Support Agency and has served on many boards of directors including EOH (Pty) Ltd, City Power Johannesburg (Pty) Ltd, State Information Technology Agency (Pty) Ltd, Statistics South Africa and the National Advisory Council on Innovation. He is a trustee of the Bradlow Foundation as well as the Carl and Emily Fuchs Foundation.