UNIVERSITI TEKNOLOGI MARA

NONLINEAR IDENTIFICATION FOR DENGUE FEVER

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Thesis submitted in fulfilment of the requirements
for the degree of
Doctor of Philosophy

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Candidate's Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

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ABSTRACT

This thesis presents the development of a non-invasive system identification for the monitoring of the progression of dengue infection based on hemoglobin concentration. Prior to the system development, a simple statistical approach were applied to process the dengue infection data. From this, five significant variables, i.e. gender, weight, vomiting, reactance and day of fever were chosen to be the input variables. All of these are non-invasive parameters.

The developed system uses the nonlinear system identification based on Artificial Neural Network (ANN), which involved Nonlinear Autoregressive (NAR), Nonlinear Autoregressive with eXogenous Input (NARX) and Nonlinear Autoregressive Moving Average with eXogenous Input (NARMAX). Each of the models is divided into two approaches, which are unregularized approach and regularized approach. The type of order selection criteria involves, The Final Prediction Error (FPE), Akaike's Information Criteria (AIC), and Lipschitz number. For comparison purposes, linear models which are Autoregressive (AR), Autoregressive with eXogenous Input (ARX) and Autoregressive Moving Average with eXogenous Input (ARMAX) were used. The findings indicate that NARMAX model with regularized approach yields better accuracy by 88.40%; this model is 100% better than the one recently published, i.e. using linear regression model with an accuracy of only 42%.

The best parameters' settings for the NARMAX model can be found using the Lipschitz number criterion for the model order selection with artificial neural network structure of 5-2-1 trained using the Levenberg Marquardt algorithm.

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