UNCERTAINTY PROPAGATION ANALYSIS OF ARTIFICIAL NEURAL NETWORK (ANN) APPROXIMATED FUNCTION USING NUMERICAL AND ANALYTICAL METHOD

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this project and in my opinion, this project is adequate in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering.

Signature
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Date: 30 NOVEMBER 2009

STUDENT'S DECLARATION

I hereby declare that the work in this project is my own except for quotations and summaries which have been duly acknowledged. The project has not been accepted for any degree and is not concurrently submitted for award of other degree.

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To my beloved father and mother

Mr Mohamad Bin Abdullah

Mrs Fatimah Binti Mohamad

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ABSTRACT

This thesis is to investigate the uncertainty analysis using numerical sequential perturbation method and analytical Newton approximation method. The objective of this project to propose the a new technique using numerical sequential perturbation in calculating uncertainty propagation compare to the use of analytical Newton approximation method in application where the unknown function is approximated using artificial neural network ANN. The process to determine uncertainty have five step including begin from selected function, randomize the data, function approximation and applied the numerical method in ANN and lastly determine percent of error between numerical with ANN and compare with the analytical method. The ANN was applied in MATLAB software. From the uncertainty analysis, was define that three major figure the end of this project. First figure shown the average error between numerical and analytical method without ANN are **0.03**%. Second figure average error of function approximate the mass flow rate compare the actual value is **0.03**%. The application with numerical method with ANN gives small uncertainty propagation error compare with analytical method where the error is **1.2**% is the last graph of this project. The new technique will be approving to determine the uncertainty analysis using artificial neural network (ANN). This technique also can be applied for application in laboratory or industrial field.

ABSTRAK

Tesis ini adalah untuk menyiasat analisis ketidakpastian menggunakan kaedah berangka Usikan bersiri dan kaedah analisis pendekatan Newton. Objektif projek ini adalah mencadangkan teknik baru menggunakan kaedah berangka Usikan bersiri dalam menghitung ketidakpastian dibandingkan dengan penggunaan kaedah analisis pendekatan Newton dalam aplikasi di mana fungsi yang tidak diketahui dianggarkan menggunakan rangkaian neural tiruan. Proses untuk menentukan ketidakpastian mempunyai lima langkah, termasuk mulai dari fungsi yang dipilih, merawakkan data, penghampiran fungsi dan menerapkan pendekatan kaedah berangka dalam rangkaian neural tiruan dan terkini menentukan peratus kesalahan antara berangka dengan rangkaian neural tiruan dan bandingkan dengan kaedah analisis. The rangkaian neural tiruan itu diterapkan dalam perisian MATLAB. Dari analisis ketidakpastian, adalah menetapkan bahawa tiga graf utama pada akhir projek ini. Graf pertama menunjukkan purata ralat diantara kaedah berangka dan kaedah analisis tanpa rangkaian neural tiruan adalah 0,03%. Graf Kedua angka purata ralat fungsi laju aliran masa dibandingkan dengan nilai sebenar adalah 0,03%. Aplikasi dengan kaedah berangka dengan rangkaian neural tiruan memberikan nilai ralat ketidakpastian kecil dibandingkan dengan kaedah analisis di mana kesalahan adalah 1,2% adalah graf terakhir daripada projek ini. Teknik baru akan dipersetujui untuk menentukan ketidakpastian analisis menggunakan rangkaian neural tiruan. Teknik ini juga boleh digunakan untuk aplikasi di makmal atau bidang industri.

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%	percent
M	Mass flow
C	Empirical discharge coefficient.
P	Nozzle inlet pressure
A	Nozzle throat area
ΔP	Upstream and Downstream Pressure Different
gc	Gravitational
R	Gas constant for air and humidity
T	Temperature of air at inlet to nozzle

LIST OF ABBREVIATIONS

ANN	Artificial Neural Network
SP	Sequential Perturbation
U%	Percent of uncertainty