DEDICATION

To my mother,

To my father,

To my wife,

ACKNOWLEDGMENT

In the name of Allah, Most Gracious, Most Merciful

First and foremost, praises and thanks to Allah, the Almighty, on whom ultimately we depend for the completion of this master's thesis. Only due to His blessings I could finish this thesis.

I would like express my unrestrained appreciation to my thesis supervisor Dr. Adam Abdelrahman Abdelkarim, for his help and guidance.

I also acknowledge all of my friends, especially my colleagues in Electrical maintenance department in Roseirs Hydro Power Plant for their encouragement and support.

ABSTRACT

In this research a non-linear model for the static excitation system of Rosiers Hydro Powered generators has been developed using MATLAB/SIMULINK integrated environment, and the response of model analyzed using step signal.

To derive the linear model of the static excitation system, closed loop frequency response test was carried out and the response of the system was approximated to a second order representation and the parameters (gain, natural frequency and damping factor) were obtained.

The resultant second order approximation was found to behave as integrator, so the linear system reduced to a first order system. Simulation is carried out for the non-linear model to verify the step response and compare it with the existing excitation system in the station.

مستخلص

فى سياق هذا البحث تم تطوير نموذج حاسوبى لا خطى لنظام الاثارة الثابت لمولدات محطة توليد كهرباء الروصيرص و تم تحليل استجابة النظام لاشارة الخطوة.

لاشتقاق النموذج الخطى لنظام الاثارة تم اختبار استجابة التردد لحالة الحلقة المغلقة و تم تقريب استجابة النظام ليتم تمثيلها بنظام من الرتبة الثانية و من ثم تم الحصول على معاملاته (الكسب, التردد الطبيعى و معامل الاخماد).

وجد ان المنظومة من الرتبة الثانية الناتجة تبدى سلوكا مشابها للمكامل و لذلك تم خفض رتبة المنظومة للرتبة الاولى. تم اجراء محاكاة للنظام اللاخطى لتحقيق استجابة الخطوة و مقارنتها مع النظام الموجود بالمحطة.

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LIST OF SYMBOLS AND ABBREVIATIONS

SYMBOLS

H(s) Transfer function

M Maximum overshoot

k System gain

ξ Damping factor

τ Time constant

ω_n Cutoff frequency

ABBREVIATIONS

A/D : Analog to Digital

AC : Alternative Current

AVR : Automatic Voltage Regulator

VAR : Volt-Amperes Reactive

CCR : Central Control Room

D/A : Digital to Analog

FFT : Fast Fourier Transform

PID : Proportional Integral Derivative

POS : Process Operation Station