AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

ON LINE IDENTIFICATION MODELS OF SYNCHRONOUS MACHINES FOR DIGITAL AUTOMATIC CONTROL PURPOSES

BY

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A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF

THE REQUIREMENTS OF THE DEGREE OF MASTER OF

SCIENCE IN ELECTRICAL ENGINEERING

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DEPT. OF ELECT. POWER & MACHINES

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CAIRO - 1990

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STATEMENT

This dissertation is submitted to Ain Shams University for the degree of Master in Electrical Engineering .

The work included in this thesis was carried out by the author in the Department of Electrical Power and Machines , Ain Shams University , from October 1986 to December 1990 .

No part of this thesis has been submitted for a degree or a qualification at another University or institution .

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ACKNOWLEDGEMENT

The author would like to thank Prof. Dr. A. K. Al-Kharashi so much for all he has done for him . His encouragement and fruitful remarks will always guide him in his future life .

The author has the honour to dedicate this modest thesis to Prof. Dr. M. A. Badr , thanking him for all the efforts he has exerted so that it could be finished .

The author express his thanks to the dept. of electrical power and machines at Ain Shams University for the experimental and computer facilities offered to him.The author thanks the personnel of the electrical engineering laboratories of the dept.for their help.

Thanks are also due to Eng.Ehab El Sadany for his kind help and guidance.

I am particularly grateful to my parents, my brother and my sister for their unwavering support and encouragement.

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ABSTRACT

Digital computers and particularly microprocessor based computers are being applied in ever increasing numbers to the different applications of controls in electrical power systems.

The design of digital controllers is usually based on linear models of plant dynamics.The increasing complexity and decreasing stability of power systems has made the determination of suitable models and the estimation of system parameters a subject of growing importance.

Models of power system are usually classifiedintooff-line models and on-line models.Off-line modelsareconstructed by knowing many details about the power system components and by using the different laws of basic science. The construction of these models is tedious, time consuming and inaccurate in some cases.On-line models , on the other hand, are constructed by gathering information about the system inputs and outputs, then these information are used by the control computer to determine the model of the system in the form of transfer functions or

difference equations.The process of obtaining informations about a system through the observation of its inputs and outputs is known as identification.

Out of the different identification methods available, the recursive weighted least squaresidentification method has been chosen for identifying the power system under study.This method has the advantages of simplicity, accuracy and suitability for application to noisy power system environment.

The mathematical models of the power system under study are formulated in the two-axis reference frame and simulated digitally to obtain the system transient response, the identifier and controller are also simulated in order to achieve the required control action.It has been proved that the second order model based on the recursive least square algorithm is very capable of representing synchronous machine dynamics even when the machine is subjected to severe operating conditions.

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LIST OF SYMBOLS

i	generator armature current
i_c	current in the series compensated line
i_d, i_q	d-and q-axis component of the generator armature current respectively
i_{fd}	field current
V	infinite bus bar voltage
V_c	voltage across the series capacitor
V_t	generator terminal voltage
V_{td}, V_{tq}	d-and q-axis component of V_t respectively
V_{fd}	field voltage
P	active power delivered to the infinite-bus
p	time operator = d/dt
Q	reactive power delivered to the infinite-bus
r_a	armature resistance
R_e	external line resistance
r_{fd}	field winding resistance
r_{kd}, r_{kq}	d-and q-axis damper winding resistance,respectively
t	time in seconds
T_i	shaft torque
X_{ad}, X_{aq}	d-and q-axis magnetizing reactance,respectively
X_d, X_q	d-and q-axis synchronous reactance,respectively
X_d', X_q'	d-and q-axis transient reactance,respectively
X_d'', X_q''	d-and q-axis subtransient reactance,respectively
X_{ffd}	field winding self reactance
X_e	external line reactance