بسم الله الرحمن الرحيم

**Ain Shams University**
**Faculty of Engineering**
**Electrical power and Machine Dept.**

# Speed Control of Switched Reluctance Motor

**M.Sc. Thesis**
**By**

**Eng. Rania Abd El Rashid Ahmed Turky**
Submitted in partial fulfillment of the Requirements for the M.Sc. Degree in Electrical Engineering

Supervised By

**Prof. Dr. Mohamed Abd Latif Badr**
Professor –Electrical Power and Machines Department
Faculty of Engineering, Ain Shams University

**Prof. Dr. Mahmoud Abd El Hamid Mostfa**
Professor –Electrical Power and Machines Department
Faculty of Engineering, Ain Shams University

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# APPROVAL SHEET

For The thesis:

## SPEED CONTROL OF SWITCHED RELUCTANCE MOTOR

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Approved by

| Name | Signature |
| --- | --- |
| Prof. Dr. Mohamed Abd Latif Badr | |
| Prof. Dr. Mahmoud Abd El Hamid Mostfa | |

Date: / / 2010

## Examiners Committee

The thesis:

## SPEED CONTROL OF SWITCHED RELUCTANCE MOTOR

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| Name, title and affiliation | Signature |
|---|---|

1. **Prof. Dr. Essam Mohamed Abo El Zahab**
   Electrical Power and Machines Department
   Faculty of Engineering
   Cairo University

2. **Prof. Dr. Adel Yousef Hanallah**
   Electrical Power and Machines Department
   Faculty of Engineering
   Ain Shams University

3. **Prof. Dr. Mohamad Abd Latif Badr**
   Electrical Power and Machines Department
   Faculty of Engineering
   Ain Shams University

4. **Prof. Dr. Mahmoud Abd El Hamid Mostfa**
   Electrical Power and Machines Department
   Faculty of Engineering
   Ain Shams University

## Statement

This thesis is submitted to Ain Shams University in partial fulfillment of the requirements for M.Sc. degree in Electrical Engineering.

The included work in this thesis has carried out by the author at the Electrical Power and Machines Department, Ain Shams University. No part of this thesis has been submitted for a degree or a qualification at any other university or institution.

**Name** **:** Rania Abd El Rashid Ahmed Turky
**Signature:**
**Date** **:** 23 / 6 /2010

**To**

**My husband, My daughter, My parents, and my sister.**

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# ABSTRACT

The switched reluctance motor (SRM) drive is nowadays one of the most considerable electric drives due to its good features that made it comparable with induction motor drives.

In this thesis, The dynamic response of an SRM has been obtained using information derived from static measurements, which give the exciting coil flux-linkages as a function of both the coil current and the angular position of the rotor. This has been achieved through a digital simulation of the mathematical model of the motor.

This model comprises a set of phase circuit equations in addition to the mechanical differential equations of motion. These equations are then solved using numerical integration of the nonlinear differential equations of the motor with the magnetization data in the form of a look-up table $\Psi(\theta,i)$. The cubic spline interpolation is used to determine the intermediate values of the variables given by the look-up table, which gives more accurate representation than other methods. This method is applied to compute the instantaneous values of current and torque for each phase, total torque and speed under different modes of operation; low speed with current control (chopped mode) and high speed with angle control (single pulse mode), and the required switching-on and off angles.

Early “traditional” controllers for SRM have a simple control technique. This control technique results in ripples in the torque and speed profiles, since the torque developed by an SRM is a nonlinear function of phase currents and rotor position. These ripples represent one of the main disadvantages of this type of motors.

The main contribution of This thesis is the presentation of a digital observer controller for switched reluctance motors for the purpose of enhancing the speed regulation of this type of motors. The dynamic response of the SRM with the proposed controller is studied during starting and under different load disturbances. The effectiveness of the proposed digital observer controller is then compared with that of both the conventional PI controller and the artificial neural network (ANN) controller. The dynamic response of the SRM with this proposed controller is found to be a fast and better-damped response.

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