Analysis and Field Oriented Control of Reluctance Synchronous Motor

By

Ahmed Farhan Mohammed Farhan

A Thesis

Submitted to Faculty of Engineering at Fayoum University in Partial Fulfillment of the Requirements for the Degree of MASTER OF SCIENCE
IN
ELECTRICAL POWER AND MACHINES ENGINEERING

Supervisors

Prof. Dr. Adel.D. Shaltout

Electrical Power and Machines Departement

Faculty of Engineering, Cairo University

Dr. Amr Abd-Allah Emam

Electrical Power and Machines Department

Faculty of Engineering, Fayoum University

FACULTY OF ENGINEERING, FAYOUM UNIVERSITY

FAYOUM, EGYPT

2012

Analysis and Field Oriented Control of Reluctance Synchronous Motor

By

Ahmed Farhan Mohammed Farhan

A Thesis

Submitted to Faculty of Engineering at Fayoum University in Partial Fulfillment of the Requirements for the Degree of MASTER OF SCIENCE
IN
ELECTRICAL POWER AND MACHINES ENGINEERING

FACULTY OF ENGINEERING, FAYOUM UNIVERSITY

FAYOUM, EGYPT

2012

Analysis and Field Oriented Control of Reluctance Synchronous Motor

By

Ahmed Farhan Mohammed Farhan

A Thesis

Submitted to Faculty of Engineering at Fayoum University in Partial Fulfillment of the Requirements for the Degree of MASTER OF SCIENCE
IN
ELECTRICAL POWER AND MACHINES ENGINEERING

Approved by the Examining Committee

Prof. Dr. Adel D.Shaltout **(Main Advisor)**

FACULTY OF ENGINEERING, FAYOUM UNIVERSITY

FAYOUM, EGYPT

2012

Abstract

Reluctance synchronous motor (*RSM*) is considered one of the brushless AC motors that have attracted great interests in recent researches. It has been argued to be viable alternative to induction motor, especially in variable speed drive applications. The main advantages of the *RSM* are the relatively low cost, robust design and the easier field weakening capability. It has theoretically no rotor losses and depends on the saliency of the rotor; it has a torque density comparable with that of the induction machine.

This thesis presents the *RSM* as one of the promising motors and introduces the latest improvements made in its design, to increase the saliency ratio, resulting in performance which matches the induction motor or even exceeds, considering the motor efficiency, power factor and torque density. The thesis discusses the design, construction and classifications of the *RSM*.

The mathematical modeling is also presented. The motor operation is studied, in both steady state and transient conditions; considering sudden loading and sudden supply voltage-sag conditions.

Field Oriented Control (*FOC*) on *RSM* discusses in this thesis, the main controlled variables are rotor speed, motor performance (steady state error, settling time and overshoot) and effecting of controller on *RSM* stability. Also the speed and position estimator (sensorless *FOC*) is consid