Faculty of Engineering

Cairo University

ROTATIONAL DRIVES AND SERVICE LIFE ANALYSIS AND ENHANCEMENT OF MOULDS OF HORIZONTAL CENTRIFUGAL CASTING MACHINES

By

MOHAMMED AHMED ALI SHEHATA

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of

DOCTOR OF PHILOSOPHY
in
Mechanical Design and Production Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2019

ROTATIONAL DRIVES AND SERVICE LIFE ANALYSIS AND ENHANCEMENT OF MOULDS OF HORIZONTAL CENTRIFUGAL CASTING MACHINES

By

MOHAMMED AHMED ALI SHEHATA

A Thesis Submitted to the

Faculty of Engineering at Cairo University

in Partial Fulfillment of the

Requirements for the Degree of

DOCTOR OF PHILOSOPHY

in

Mechanical Design and Production Engineering

Under the supervision of

Prof. Dr. Saad Kassem	**Prof. Dr. Ahmed Bahgat**
……………………..	……………………..
Mechanical Design and Production Department	Power Electrical Machines Department

Faculty of Engineering, Cairo University

Dr. Mohamed Elgamil

………………….

Assistant Professor
Mechanical Design and Production Department.

Faculty of Engineering, Cairo University

FACULITY OF ENGINEERING, CAIRO UNIVERSITY

GIZA, EGYPT

2019

ROTATIONAL DRIVES AND SERVICE LIFE ANALYSIS AND ENHANCEMENT OF MOULDS OF HORIZONTAL CENTRIFUGAL CASTING MACHINES

By

MOHAMMED AHMED ALI SHEHATA

A Thesis Submitted to the
Faculty of Engineering at Cairo University
In Partial Fulfillment of the
Requirements for the Degree of

DOCTOR OF PHILOSOPHY

in

Mechanical Design and Production Engineering

Approved by the
Examining Committee

Prof. Dr. Saad Kassem (Thesis Main Advisor) ....

Faculty of Engineering at Cairo University

Prof. Dr. Ahmed Bahgat (Advisor) ………………

Faculty of Engineering at Cairo University

Prof. Dr. Layla Byoumi (Internal Examiner) ……………...

Faculty of Engineering at Cairo University

Prof. Dr. Mervet Badr (External Examiner) ……………..

National Research Centre

FACULITY OF ENGINEERING, CAIRO UNIVERSITY

GIZA, EGYPT

2019

Engineer's Name: Mohamed Ahmed Ali Shehata
Date of Birth: 28/7/1976
Nationality: Egyptian
E-mail: shehatamech@gmail.com
Phone: 01008890849
Address: Bortos – Oseem – Giza

Registration Date: **1 / 10 / 2010**

Awarding Date: **……./……/ 2019**
Degree: Doctor of Philosophy
Department: Mechanical Design and Production Engineering
Supervisors:

Prof. Dr. Saad Kassem
Prof. Dr. Ahmed Bahgat
Dr. Mohamed A. Elgamil

Examiners:

Prof. Dr. Saad Kassem (Thesis main advisor)
Prof. Dr. Ahmed Bahgat (Advisor)
Prof. Dr. Layla Byoumi (Internal examiner)
Prof.Dr. Mervet Badr (External examiner)
(National Research Centre)

Title of Thesis:

ROTATIONAL DRIVES AND SERVICE LIFE ANALYSIS AND ENHANCEMENT OF MOULDS OF HORIZONTAL CENTRIFUGAL CASTING MACHINES

Key Words:

Mould, Centrifugal Casting, Service Life, Misalignment, Thermo-mechanical

Summary:

In this research work a centrifugal casting machine driven by a separately excited DC motor and proposed AC motor is investigated. The study has been carried out using two methods of simulation; mathematical modeling and laboratory experiments. The mathematical model has been validated by comparing the simulation results with actual measurements taken with the DC drive. On the other hand, In order to regain the mould expected service life, for improving the operation economic and technical sides, a study of the factors that reduce this life was carried out. The strain measurements were used as indirect indicator for adjusting the mould alignment. The study conclusions were used to develop recommendations and prepare action plans that would improve the mould service life.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that i have appropriately acknowledged all sources used and have cited them in the references section.

Name: Date:

Signature:

AKNOWLEDGEMENT

A lot of thanks to **GOD** for giving me the power and perseverance to accomplish this work.

I would like to acknowledge with thanks Prof. Dr. Saad Kassem for his contributions and guidance, for his valuable opinions and suggestions throughout the work. His valuable suggestions regarding the thesis layout and his review of the manuscript are much appreciated. I am greatly indebted for his continued, encouragement and patience.

I wish as well to thank Prof. Dr. Ahmed Bahgat for his interest in the work, encouragement, and continuous support. His valuable comments regarding the theoretical and experimental work dedicated to the electric drive and control systems are much appreciated.

I would like also to express my deep gratitude to Dr. Mohamed El Gamil for suggesting the subject of this thesis, his constant guidance and valuable support. He did every possible effort to help and advise me during the course of the research as well as during drafting the thesis. His continuous support and valuable comments are much appreciated.

Also I would like to thank Dr. Bassam Abd EL Latief, department of Mechanical Design and Production for his assistance during the development of the mathematical model and field measurements of mechanical vibrations.

I very much value the support of the management of El-Nasr Castings Company to encourage this research work dedicated to solve two actual-plant problems. Gratitude is also for Eng. M. Naguib and Eng. A. Madian of El-Nasr Castings Company for their co-operation and help.

Finally I deeply thank my family and my wife for the encouragement and patience they showed throughout my Ph.D. study especially throughout the last year during which the thesis was drafted.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES