

بسم الله الرحمن الرحيم



**Sudan University of Science and Technology**  
**College of Graduate Studies & Scientific Research**

**EFFECT OF EXHAUST GAS RECIRCULATION AND WATER  
INJECTION ON DIESEL ENGINE PERFORMANCE AND  
EXHAUST EMISSIONS**

تأثير إعادة تدوير غازات العادم و حقن الماء على الأداء وانبعاثات غازات  
العادم في محرك الديزل

**A THESIS SUBMITTED IN FULFILLMENT FOR THE DEGREE  
OF DOCTOR OF PHILOSOPHY (PhD) IN MECHANICAL  
ENGINEERING**

**School of Mechanical Engineering – College of Engineering  
Sudan University of Science and Technology**

**Presented by**

**Eihab Abdelraouf Mustafa Omer**

**Supervisor**

**Prof. Dr. Sabir Mohammed Salih**

July 2012



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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

\* اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ \*

\* خَلَقَ الْإِنْسَانَ مِنْ عَلَقٍ \*

\* اقْرَأْ وَرَبُّكَ الْأَكْرَمُ \*

\* الَّذِي عَلَّمَ بِالْقَلَمِ \*

\* عَلَّمَ الْإِنْسَانَ مَا لَمْ يَعْلَمْ \*

صدق الله العظيم

العلق الآيات (1- 5)

## **PREFACE**

This thesis is submitted in fulfillment for the degree of Doctor of Philosophy at the Department of Mechanical Engineering in the Sudan University of Science and Technology. The research described herein was carried out under the supervision of Professor Sabir Mohammed Salih from the School of Mechanical Engineering, Sudan University of Science and Technology (SUST) between July 2009 and July 2012.

This work is original to the best of my knowledge, except where acknowledgements and references are made to previous work. Neither this, nor any substantially similar thesis has been or is being submitted for any other degree or other qualification at any other university. This thesis contains no more than 58,000 words.

*To My Mother and My Father*

*On Their Best Upbringing*

*To My Wife and My Children*

*On Their Forbearance*

*To All Mechanical Engineers*