



AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

MECHATRONICS ENGINEERING

Regenerative Anti-Lock Braking System

A Thesis submitted in partial fulfillment of the requirements of the

M.Sc. in Mechanical Engineering

By

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Cairo – (2018)



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Statement

This thesis is submitted as a partial fulfillment of M.Sc. degree in Mechanical engineering, Faculty of Engineering, Ain Shams University.

The author carried out the work included in this thesis and no part of it has been submitted for a degree or qualification at any other scientific entity.

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Abstract

The braking system of vehicles uses the usual technology of hydraulic braking that generates thermal energy out of the loss of kinetic energy which is being resulted from difference in motion of pads and wheels. The Regenerative Braking System (RBS) works on converting the excess kinetic energy into electrical energy that can be used in recharging the car battery during the vehicle deceleration.

The usual RBS has some limitations that are related to the vehicle speed; as in low speed which is less than 10 km/h the system is inefficient to convert the kinetic energy and generate current. Also the RBS is incapable of completely stopping the vehicle regardless of the traveling speed.

The study in this conducted thesis emphasizes the Regenerative Anti-lock Braking System (RABS) in saving energy and reducing energy loss, also enhancing braking performance at low speed rates by detecting the type of terrain surface.

RABS comprehensive model has been constructed on Matlab / Simulink for simulation purposes in order to collect reliable results about system performance and calculate the speed ranges of the wheel which differ according to the type of the surface after the first hit on the brakes in a given time to use these speed ranges in terrain detection process in the experimental test rig.

The experimental test rig has been constructed on a hybrid golf cart in two different modes; one of which is speed reducing mode and the other one is stopping mode and shows multiple conditions of braking such as braking on

non-slippery surfaces as dry-surface (asphalt) and braking on slippery surfaces as wet-surface (asphalt) and oily-surface (asphalt).

It is found from the simulation and test rig that the RABS which is conducted in this thesis provides satisfactory braking performance and recovered energy reaches to 30 % of energy losses in thermal energy.

Key words: Conventional Braking System, Anti-Lock braking System, Regenerative Braking, Hybrid Electric Vehicle, Motor Generator, State Of Charge

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List of Technical terms and abbreviations

RBS	R egenerative B raking S ystem
MG	M otor G enerator
ABS	A nti-lock B raking S ystem
RABS	R egenerative A nti-lock B raking S ystem
EV	E lectric V ehicle
HEV	H ybrid E lectric V ehicle
SOC	S tate O f C harge percentage
EM	E lectric M otor
RPM	R evolutions P er M inute
IDE	I ntegrated D evelopment E nvironment