



**STRUCTURAL ANALYSIS OF AN
ERGONOMIC MOTORCYCLE TEST RIG
USING FINITE ELEMENT ANALYSIS (FEA)**


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“ I declared that this thesis is the result of my own work except the ideas and summaries which I have clarified their sources. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any degree. ”

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ABSTRACT

Motorcycle has been a preferable transportation option for Malaysians whether to travel in near or far distances. Shockingly, a research carried out shows that more than 50% of road accidents in Malaysia involve motorcyclists. As part of an effort to reduce motorcycle accidents in Malaysia, an ergonomic motorcycle test rig called the *Postura Motergo* was built to study motorcyclists' riding postures that lead to muscle fatigue that has been identified as amongst the factors causing motorcycle accidents. In supporting the test rig's design team, structural analyses of the chassis and whole assembly is necessary before the blue print can be approved for fabrication. Computer Aided Design (CAD) models of the test rig were being analyzed using Generative Structural Analysis (GSA) package in the state-of-the-art CATIA V5R20 software. Analysis simulations were done on preliminary design of the test rig to predict early failures and bad designs. From there, the design was detailed out by the test rig's design team before coming out with a final design that was also analyzed using FEA simulations. In this project, several parameters were considered such as the loading and material that was assigned to the CAD model. The material assigned on the CAD model was the same material used to fabricate the test rig that was mild steel. Tetrahedron mesh was used to generate the meshes on the finite element model. Boundary conditions were located at each area that is assumed to have zero degree of freedom (DOF) in real condition. The loading applied was 150kg taking a maximum average weight of a motorcyclist. Based on the FEA simulation results, deformation, Von Mises stress and displacement of the test rig can be obtained. The test rig's Von Mises Stress value was 1.79×10^8 MPa when 150kg of weight was applied. Since the yield strength of mild steel is 2.00×10^8 MPa, the factor of safety obtained was 1.12. This shows that the designed test

rig can still yield the 150kg weight and will not fail upon operation. With the positive results obtained from the FEA simulations, the *Postura Motergo* got its approval to be fabricated and safe to be used for further motorcycle ergonomics researchers especially the Motorcycle Engineering Test Lab (METAL) researchers.

TABLE OF CONTENTS

CONTENTS		PAGE
	PAGE TITLE	i
	AKNOWLEDGEMENT	ii
	ABSTRACT	iii
	TABLE OF CONTENTS	v
	LIST OF TABLES	viii
	LIST OF FIGURES	ix
CHAPTER 1	INTRODUCTION	
	1.1 Project Summary	1
	1.2 Problem Statement	2
	1.3 Objectives of Project	3
	1.4 Scope of Project	3
	1.5 Significance of Project	4
CHAPTER 2	LITERATURE REVIEW	
	2.1 Introduction	6
	2.2 Motorcycle Accidents in Malaysia	6
	2.3 Ergonomics on Motorcycle	7
	2.4 Computer Aided Engineering	9