Cairo University

STRUCTURAL HEALTH MONITORING USING PIEZOELECTRIC FIBER COMPOSITES

By

Khalid Mohamed Lotfy Shalan

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Mechanical Design and Production Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Under the Supervision of

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Approved by the
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Title of Thesis:

Structural Health Monitoring using Piezoelectric Fiber Composites

Key Words:
Structural Health Monitoring, Piezoelectric Fiber Composite, Modal Analysis, Electromechanical Impedance, Smart Materials.

Summary:

The present study examines Piezoelectric Fiber Composites (PFC) for structural health monitoring applications. Piezoelectric composites have an advantage over piezoceramic wafers in terms of mechanical properties. However, piezoelectric composites introduce high complexity to analyze given their heterogeneity. A micromechanics-based model employing Transformation Field Analysis (TFA) evaluates the homogenized properties of PFCs. Macroscale study is performed on commercial Finite Element (FE) package, ABAQUS. PFCs are employed as modal sensors and actuators to test structures for damage.

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Dedication

To my parents, Mohamed and Bahiya, I am grateful for your continuous support far beyond my eloquence can describe. And to My, may our best be yet to come.

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