

Engine and Auxiliary Systems

Edited by
Prof. Dr. A.K.M. Mohiuddin



IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011
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Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

A.K.M. Mohiuddin
Engine and Auxiliary Systems
A.K.M. Mohiuddin

ISBN: 978-967-418-216-8

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
IIUM PRINTING SDN. BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan

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Development of automatic magnetic particle system for automotive parts inspection

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Introduction

In manual Magnetic Particle Inspection (MPI), achieving zero-defect principles in quality management concerning the inspection reliability, such as very low false negative rate in order to avoid pseudo scrap, cannot be satisfactorily attained [1]. Therefore, processing techniques such as magnetization, spraying of magnetic ink, black-light illuminating, optical pickup of the magnetic particle indication and analysis of these by machine vision procedures like pattern segmentation and recognition need to be automated. This also includes supervising procedures like control of the black-light intensity and/or the quality of the liquid powder suspension, such as rate of powder deterioration by separation of powder and the fluorescent color. Other components and applications for automated magnetic particle inspection have been suggested [2-10]. Since MPI is still the most sensitive surface crack inspection method, variability of human interpretation and variation in components can reduce the reliability of magnetic particle inspection flaw detection to only about 70%. Hence the need for an on line, heavy duty, high speed parts inspection with on line documentation and near 100 percent flaw detectability within calibrated equipment, if possible, by using modern electronic systems that can also achieve lower costs [2].

This chapter describes the development and incorporation of an automated system into an existing manual MPI machine. This automated setup will be comprised of a magnetic testing machine, a machine vision structure, and self-controlling system.

Magnetic Particle Inspection

Magnetic particle inspection is a nondestructive method for the detection of defects in ferromagnetic materials. Application of a magnetic field or current flow through the material is used in combination with the principle that the magnetic susceptibility of a defect is markedly poorer (the magnetic resistance is greater) than that of the surrounding material. In theory, magnetic particle testing is a relatively simple concept. It can be considered as a