

# MECHATRONICS BOOK SERIES

## CONTROL AND INTELLIGENT SYSTEMS

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Momoh Jimoh E. Salami  
Abiodun Musa Aibinu  
Yasir Mohd Mustafah



IIUM Press

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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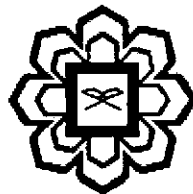
# CONTROL AND INTELLIGENT SYSTEMS

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**Momoh Jimoh E. Salami**

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## Chapter 32

### Machine Intelligence: MIQ, MSQ, and MEQ

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#### 32.1 Introduction

Increasingly, human is relying on machines to accomplish many tasks. With the concomittant increase in the complexity and nature of tasks to be delegated to machines, they must be equipped with some degree of intelligence to be able to truly function with minimum intervention from huamn ocpartors and managers.

Artificial intelligence (AI) has been the vehicle for implementing intelligence in machines which is one of the human characteristics. After Simon et al. first introduced AI in 1956, various definitions of machine intelligence have been published. However, viewpoints and concepts are still abstract and ambiguous. One of the earliest papers to address the question of machine intelligence specifically in relation to the modern digital computer was written in 1950 by the British mathematician Alan Turing. The Turing test, also called the imitation game, measures the performance of an allegedly intelligent machine against that of a human being, arguably the best and only standard for intelligent behavior. This test provides a basis for many of the schemes actually used to evaluate modern AI programs. A program that has potentially achieved intelligence in some areas of expertise may be evaluated by comparing its performance on a given set of problems to that of a human expert.

#### 32.2 Machine Intelligence Quotient

Intelligence quotient (IQ) is derived from one of several different standardized tests designed to assess human intelligence relative to the average performance of others of the same age. Person with high IQ is considered intelligent. In the case of machine Intelligence Quotient (MIQ), it has been interpreted by many researchers in different ways. Bien [1, 2] and Kim [3] were the earliest researchers who defined MIQ as an indicator of machine intelligence. MIQ is significantly different from other well-known indices such as control performance, reliability, and fault diagnosis capability. In the past few years, MIQ concepts developed by Bien and Kim were applied in many different research set ups, such as determination of intelligence level in nuclear power plant [4] and in distributed network set up [5].

Despite the similarity between IQ and MIQ in that both are indicators of intelligence, IQ is class-independent but MIQ is class-dependent. The IQ test is applicable to all, but MIQ test is different for every different items i.e. MIQ of cameras and MIQ of washing machines involve different dimensions and different tests. Moreover, IQ is time-independent whereas MIQ is time-dependent as the dimensions and tests of machines change with time.

In general, the more intelligent a machine, the less human intervention is required for its operation.

**32.2.1 MIQ Measurements.** Among techniques of measuring the MIQ are as follows:-

- a) Bien [1] considered the issues of MIQ from the ontological and phenomenological points of view on intelligent machine and proposed two simplistic methods of measuring MIQ. They claimed that MIQ can be a measure of the performance of the