MECHATRONICS BOOK SERIES

CONTROL AND INTELLIGENT SYSTEMS

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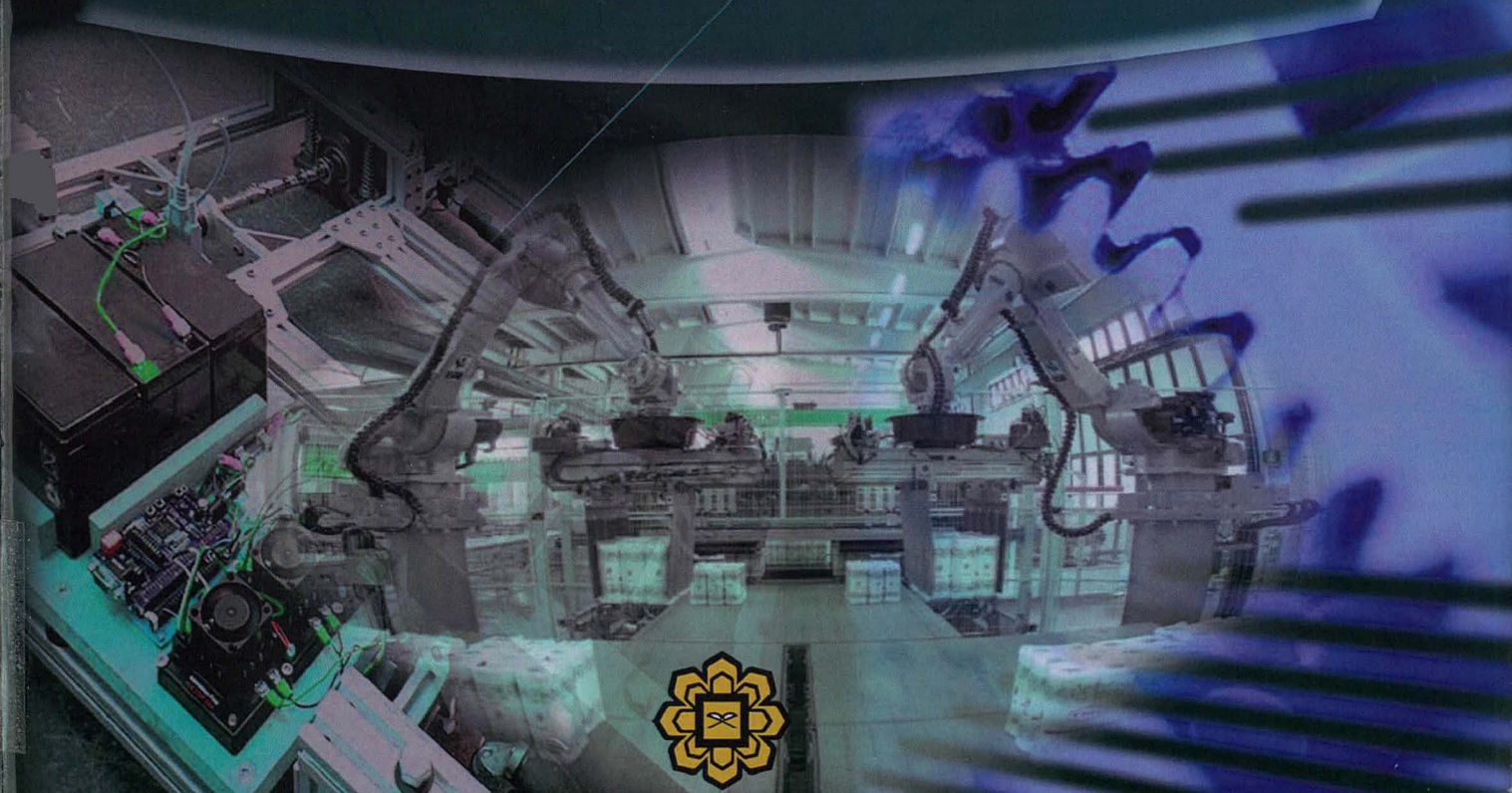
Yasir Mohd Mustafah



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Chapter 45
Fault Tree Analysis, A case study of a simple Line Following Robot

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45.1 Introduction

Fault tree analysis (FTA) is a top-down approach to failure analysis, starting with a potential undesirable event (accident) called a TOP event, and then determining all the ways it can happen [1]. FTA is used most often in: (1) root cause analysis which involves: identifying all relevant events and conditions leading to undesired events; determining parallel and sequential event combinations; Model diverse/complex event interrelationships involved (2) risk assessment which involve Calculating the probability of an undesired event (level of risk); Identify safety critical components/ functions / phases; measure effect of design changes (3) design safety assessment for demonstrating compliance with requirements; Showing where safety requirements are needed; identifying and evaluate potential design defects and determine common mode failures.

FTA allows the use of reliable information on component failure and other basic events to estimate the overall risk associated with new system designs for which no historical data exists and simple to understand and implement. It gives a qualitative descriptions of potential problems and combinations of events causing specific problems of interest and **quantitative** estimates of failure frequencies and likelihoods, and relative importances of various failure sequences and contributing events. FTA can be use to produce lists of recommendations for reducing risks and also in the quantitative evaluations of recommendation effectiveness.

Despite the extensive advantages associated with the use of FTA, it has some drawbacks among which are; it might be difficult to conceive all possible scenarios leading to the top event and construction of fault trees for large systems can be tedious. Furthermore, correlations between basic events (e.g. failure of components belonging to the same batch) are difficult to model and exact solutions to correlated events do not exist in some cases and subjective decisions regarding the level of detail and completeness are sometimes not easy to handle.

45.2 Simple Examples of FTA

In order to understand the detailed analysis of FTA, some basic examples will be presented in this chapter. These include simple series and parallel circuits.

Example 1

1) A basic circuit is shown in figure 44.1