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A FINAL YEAR PROJECT REPORT
BACHELOR IN MECHANICAL ENGINEERING (HONORS)

PERFORMANCE ANALYSIS OF GAS TURBINE

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We are proud to our willingness to complete this project, which is the first ever and can be treated as the starting point especially in UiTMARA involving in the Turbo machinery studies, particularly in an Industrial Gas Turbine Unit. We are hopping so much that there will be a continuous studies and enhancement on this challenging field in future especially in UiTMARA. This is due to great scope of career to be developed from now with a promising valuable experience and return. Who knows in next 10 years time, our country will be able to produce our own Gas Turbine especially Industrial Gas Turbine where Malaysia has become one of an Industrial country.

May ALLAH bless all of us.

ABSTRACT

This project is about studying the performance of gas turbine with the aid of a Programme that has been written in FORTRAN 77 language. By fixing the certain parameters as an input data based on *thermodynamics properties*, *gas data*, *mass flow rate*, *rotor speed* and *annulus size*, then the duty coefficients that is ψ (work coefficient) and ϕ (flow coefficient) and also other parameters such as dimensionless velocity triangles, Mach number and etc. can be determined. All the parameters that have been calculated are very useful during evaluating the performance of gas turbine (will be discuss in Chapter 3).

As an additional, this programme is only calculating all the parameters at the mean radius. As a start we assume there is only one stage involved for convenience purposes during writing the programme. About the programme (called Programme *FI-PSI*), it's contained 5 subroutines, which are: -

1. Subroutine Axial velocity
2. Subroutine Blade speed
3. Subroutine Deltah
4. Subroutine Mach
5. Subroutine Station

Three of them (1, 2 and 3) are used for calculating the duty coefficients and the rest is to calculate the condition at each station and the variation of Mach number at each stages (as shown in Main Programme flow chart).

Despite, this is a simple programme, but in the education point of view it is very useful when we are dealing with a turbo machinery subject.

TABLE OF CONTENT

2.0 INTRODUCTION

Turbine in many respects is the most satisfactory compare with the various means of producing mechanical power. The absence of reciprocating and rubbing members exceptionally low and that reliability can be high. The inherent advantages of the turbine were first realized using water as the working fluid and hydroelectric power is still a significant contributor to the world energy resources. Steam turbine has begun its career on the twentieth century, quite apart from its wide use as a marine power plant and has become the most important prime mover for electricity generation. In spite of its successful development, the steam turbine does has inherent disadvantages, where the production of high-pressure high-temperature steam involves the installation of bulky and expensive steam generating equipment, whether it be conventional boiler or nuclear reactor. The significant feature is that the hot gases produced in the boiler furnace or reactor core never reach the turbine, they are merely used indirectly to produce an intermediate fluid, namely steam. A much more compact power plant results when the water to steam step is eliminated and the hot gases themselves are used to drive the turbine. Serious development of the gas turbine began not long before the Second World War with shaft power in mind, but attention was soon transferred to the turbojet engine for aircraft propulsion. The gas turbine began to compete successfully in other fields only in the-mid nineteen fifties, but since then it has made a progressively greater impact in an increasing variety of applications.

To produce an expansion through a turbine a pressure ratio must be provided, and the first necessary step in the cycle of a gas turbine plant must