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LAPORAN PROJEK TAHUN AKHIR

KURSUS DIPLOMA LANJUTAN KEJURUTERAAN AWAM

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ANALYSIS AND DESIGN OF
DOUBLE LAYER SPACE GRID SYSTEM TRUSS.

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A B S T R A C T

This project report contains the analysis and design of a double layered space frame structures. The geometric forms used in this analysis and design were the two way and three way systems referred to as the square on square offset and octahedra-tetrahedra grid respectively.

All analysis were made on the results obtained from the ICL 1900 Series SPACEFRAME package program which is available at ITM Computer Centre. The method of calculation used by package is based on one described by R.K Livesley in Analysis of Rigid Frames by an Electronic Digital Computer.

The purpose of the work is to introduce one of the important applications of the technique in the analysis of symmetry structures in which the running time of the computer package program is reduced. In this technique, it is enough to solve half or a quarter of the structure and then the internal forces and displacement of the other portion are found by symmetry. Therefore a symmetry structures having large number of joints and members can be analysed by considering only portion of the structure.

This work also covers the studies of forces in the members by varying the spans, the effect of changing support conditions, the optimum method of design by varying the size of members and finally to define the limitations in analysing space structures by using ICL 1900 Series SPACEFRAME package program.

A C K N O W L E D G E M E N T

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1.0 INTRODUCTION

In a plane, two dimensional structure all the elements lie in the same plane, whereas in a space structure the component parts form a three-dimensional assembly. An ordinary roof truss or a portal frame is a typical example of a plane system. Such a system can resist only loads applied in its own plane. A dome is a typical example of a space structure. It cannot be considered or analysed as a plane system. It can resist loads applied at any point, at any inclination to the surface of the structure and acting in any direction. There are various types of space systems which can usually be subdivided into three main classes: skeleton frameworks consisting of a number of bars interconnected at nodes, stressed skin systems in which the covering forms an integral part of the structure and suspended structures. Braced domes, braced barrel vaults and double-layer grid frameworks are typical examples of the skeleton type. Folded plate structures belong to the stressed skin system, and cable roof structures to suspended type.

In nearly all buildings there is now a general tendency to reduce the number of intermediate columns and as a result there is a trend towards large span structures. There is also great emphasis on prefabrication and mass-production in the factory. The introduction of industrialised systems is an answer to demand for increased speed of construction and a possible reduction in cost.

All these requirements are satisfied by modern space structure. They are ideally suited to covering exhibition halls, assembly rooms, swimming pools and industrial buildings, in which large unobstructed areas are required.

The recent emphasis on prefabrication has drawn the attention of designers to the fact that space frames can be built up from simple prefabricated units, in many cases of standard size and shape.