EXPERIMENTAL AND THEORETICAL INVESTIGATION OF A THREE-WAY DOUBLE-LAYER SPACE GRID SYSTEM TRUSS

by

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SYNOPSIS

This project report contains the theoretical and the experimental investigation of a three-way double-layer space grid system truss.

In the theoretical analysis, computer programs were developed to solve the theoretical model. The programs were based on

a. Stiffness Method
b. Plate Analogy with regard to Prof. D.T.Wright's paper.

Both programs were developed on the assumption that the joint has a pin effect. The program developed in Method (a) offers the solution for any pin-jointed structure. In Method (b) the program was developed for a double-layer space truss.

In the experimental investigation a model of a three-way double-layer space grid system was set up. The measurements of forces in selected members and the vertical displacements at selected joints were carried out by the used of strain gauges and dial gauges respectively. A wheatstone bridge circuit was used in the measurement of member forces.

A comparison was made on the results obtained to the result obtained from the 1900 series SPACEFRAME package program which is available at the ITM Computer Center.

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I N T R O D U C T I O N

Most structures in common use consist of elements such as beams, girders and portal frames which are basically two-dimesional from the point of view of analysis as well as design. Interconnecting members in the third dimension are nearly always of a secondary character, present merely for purpose of transfering load and not sharing in the main supporting function of the structure. The fundamental advantage and economy of a form of a structural assembly in which there is integrated load - sharing is obvious, since every part of the structure makes an effective contribution. No single member is necessarily a principal one and a failure or defect in an individual element is not a matter of special consequence.

Space structure in which the three - dimensional function is realised are thus of considerable potential importance, and they are being used in the work of building ans structural engineering to an increasing extent. Space structures essentially involve and design in three rather than two dimensions. Thus, a space structure can be define as ' a three - dimensional assembly of elements, resisting loads which can be applied at any point, inclined at any angle to the surface of the structure and acting in any direction'.

The term is used to describe a wide range of inter-connected structural assemblies and structural forms, such as braced domes, braced barrel vaults and single and double - layer grids. It includes folded - plate and stressed - skin systems generally, but excludes shell - types of construction which - because of their popularity in concrete and specialised design form a seperate field.

Large intermediate column free area could be obtained by the construction of space structures. There are various domes which already cover wide span up to 200 m (600 ft)