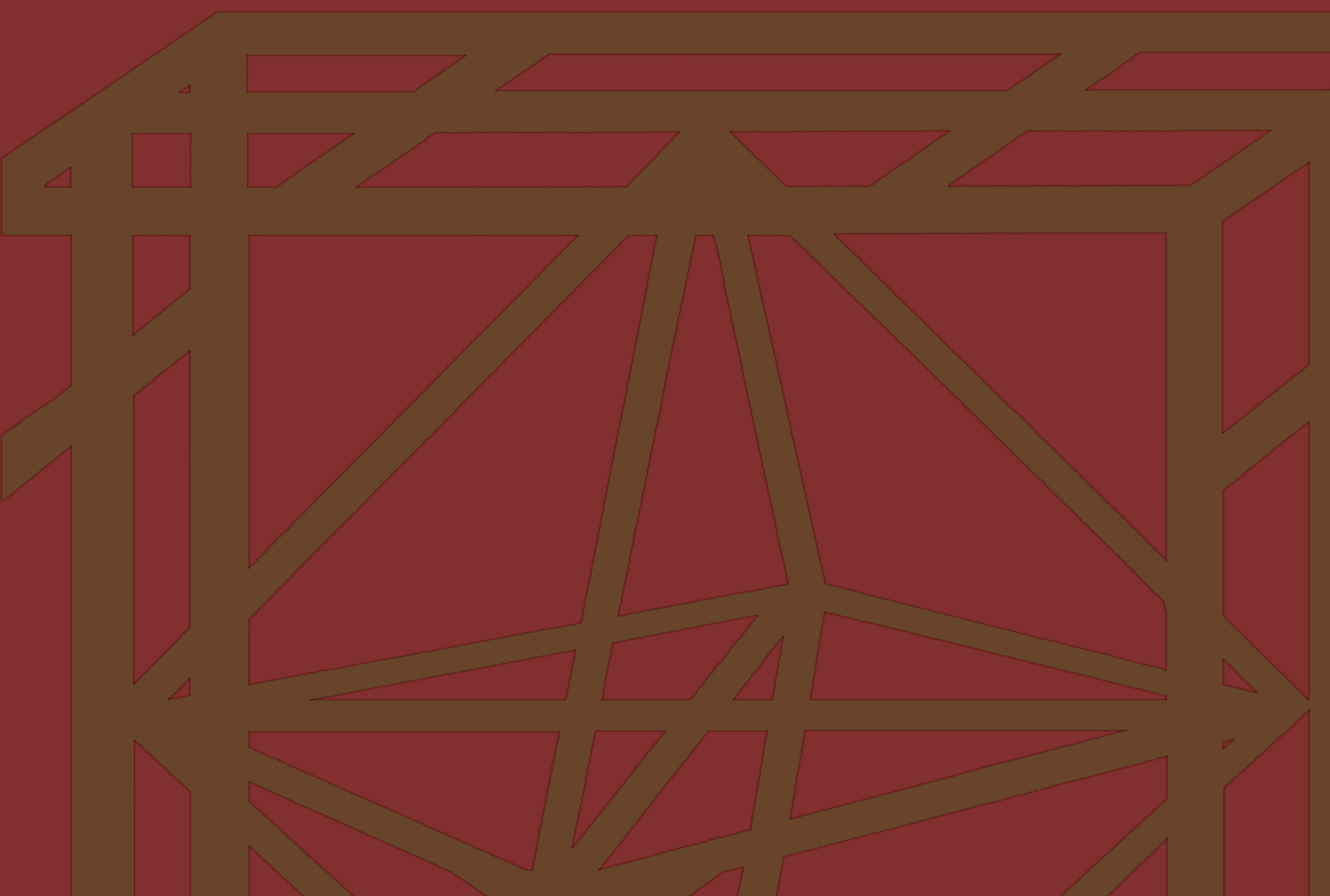
COMPUTER ANALYSIS OF SKELETAL STRUCTURES

C. T. F. Ross   T. Johns



Computer analysis of skeletal structures

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C. T. F.ROSS
PhD, C.Eng, FRINA
Principal Lecturer in Mechanical Engineering
Portsmouth Polytechnic

and

T. JOHNS
C.Eng, MRINA
Experimental Officer
Portsmouth Polytechnic

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The publisher has gone to great lengths to ensure the quality of this reprint but points out that some imperfections in the original may be apparent

Contents

Introduction

The static analysis of skeletal 1, 2, 3 structures is of much interest in many branches of engineering. In the past, the structural investigation of such structures was carried out by analytical methods, but considerable difficulty was experienced when three dimensional structures had to be analysed.

For such cases, the three dimensional structure was often approximated by a number of one dimensional and two dimensional structures. In general, this was undesirable as the magnitude of the safety factor was unknown and in any case, was probably too large.

In recent years, however, with the enormous advances made in electronics, it has been found viable to carry out a more sophisticated analysis of structures with the aid of digital computers and associated equipment. Thus, the writing of computer programs has been a major role for a number of structural analysts.

In the present text, five computer programs are presented in FORTRAN. They form a supplement to a number of booklets [2–5] written by the senior author on computer methods and ALGOL programs for structural analysis.

Although ALGOL is a superior language to FORTRAN as far as the manipulation of matrices is concerned, the latter is a more universal language and is widely available for mainframe and mini computers. In any case, it is possible to make FORTRAN partially dynamic for matrix manipulation and to some extent this is incorporated in the present series of computer programs.

The programs in Appendices A to D have been written for smaller frameworks and the solution of the simultaneous equations has been achieved by inverting the stiffness matrix.

The program in Appendix E is for the analysis of a rigid-jointed space frame with six degrees of freedom per node. For such frameworks the stiffness matrix is usually large, and this program has been written to cater for these cases by storing only the half bandwidth of the stiffness matrix.

To simplify input, many of the READ statements are written in free format. Most of the subroutines which are common to all the programs are given in Appendix F. The subroutines SOVBD2 and INVMX are not given, as a similar subroutine to the former is presented in [6] and the latter is normally available with most systems.

Summary

Five computer programs are presented in FORTRAN together with descriptions of how to use them. The programs are written in standard FORTRAN IV, apart from the READ statements, which are in free format. Thus, with very little modification, the programs could be made suitable for most computers which run FORTRAN IV programs.

The programs given in Appendices A to C are for one and two dimensional structures and have been written in a simplified manner to assist the reader to follow the various programming steps. They, like the program in Appendix D, are suitable for the solution of small and medium sized structures. The programs given in Appendices D and E are intended for the solution of three dimensional structures.

The program of Appendix E is much more sophisticated than the other programs and this increased sophistication was found a necessary prerequisite for this class of structure, which, in general, is large.

Several worked examples are given and these include pin-jointed plane and space trusses, continuous beams, and two and three dimensional rigid-jointed frames. The loading on these structures is of a number of different types, such as concentrated loads and couples, and uniformly and hydrostatically distributed loads.