DEVELOPMENT OF A FINITE ELEMENT METHOD SOFTWARE PACKAGE (FOR STRUCTURAL ANALYSIS):

A THESIS

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CONTENTS

CHAPTER 5

5. CONCLUSIONS AND RECOMMENDATIONS

The first of the three objectives of this research is to develop a finite element software package. The reseacher successfully developed this software package and a listing of the source code is in Appendix-F. In addition, a sample diskette on the software package is attached to the back cover. This package is useful for 3-dimensional beam and truss models. As described in detail in Chapter 4, this software package is comprised of four separate subroutines. This package is useful for up to 21 nodes and is limited only by the RAM capacity of the computer.

The FEM software package that the researcher developed may, however be used for analyses on models with more than 21 nodes provided that the diskette is loaded into a computer with greater RAM capacity.

The second objective of this study is to compare the results between the conventional method of structural analysis with that of Finite Element Method and with that of the experimental method. As discussed in chapter 4, the researcher has highlighted the results and the conclusion is that there is very close similarity in results between the conventional and Finite Element Method. Both of these two methods differ from the experimental results by -10 percent to 20 percent. The negative sign(-) indicates that the experimental results are less than FEM results. The normal practice is to apply a factor of safety to the results of the conventional solution. The same practice can be applied to the results of the FEM solution. Meaning, that the FEM results should be multiplied by the corresponding factor of safety, since after all, the FEM and conventional results are equivalent. It is , however , most advantageous to use the FEM since the computatioal time in FEM is greatly reduced as compared to the conventional method.

Another advantage of the FEM solution is that in the indeterminate case, the FEM is also superior. This is due to the fact that the conventional method is more cumbersome, specially for indeterminate cases wherein significantly more equations need to be developed and subsequently more simultaneous operations performed in order to achieve a solution.

The last objective of this study is to apply the FEM to structural analysis. The tables describing model 1 through model 5 have already been described in chaper 4. This includes three cantilever configurations using three types of cross-section (L cross-section, hollow square cross-section and T cross-section). The other applications in this study include the simple beam, the continuous beam, the truss structure and the frame structure. The software package developed in this study easily did the calculations and solved for the deflections, forces, moments and nodal rotations.

Also, the researcher discovered that in the process of experimentation there is great possibility for errors. For instance, the young's modulus, as calculated from the Universal

Testing Machine is a main source of error because this value affects the rest of the calculations. So the reseacher suggests that there be great care in preparation so that the specimen truly have smooth flat surfaces, with no specks, and with no pre-stress. The rust must be removed before measuring the size of material. In the actual test model, (a) the initial load, (b) the stable base and (c) the weld connections are so critical that sgain, the researcher exercise great care in order to reduce errors.