

## CLASS EXPERIENCE WITH MSC-PAL

by

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### ABSTRACT

The Civil Engineering curriculum at the University of Louisville includes several courses in which the students used professionally developed computer programs, such as the MSC-PAL program. The students are also required to develop simpler versions of some of the professional programs and to compare results obtained by the two programs.

This paper presents a report of classroom experience using the MSC-PAL C and MSC INTRO Programs in teaching undergraduate and graduate courses as well as a seminar offered in the Continuous Studies Program at the University of Louisville.

### COURSES USING MSC-PAL

The MSC-PAL Introductory Program has been used in teaching the following courses in the Department of Civil Engineering at the University of Louisville:

1. Fundamentals of Structural Analysis, CE 330 - This is the first course in structures in which the students used the MSC-PAL INTRO to check solutions obtained manually. The emphasis in this course is on classical methods of structural analysis. However, the students are also exposed to an elementary introduction to modern methods of analysis adaptable to computer programming. The use of the MSC-PAL Program is limited to check results for some simple structural beams and plane trusses analyzed manually.
2. Indeterminate Structures, CE 331 - The MSC-PAL INTRO Program is now used in this second course in structures to solve two- and three-dimensional framed structures under static loads. These solutions are then used to check results obtained for the same structures using computer programs developed in class.
3. Theory of Plates and Shells, CE 620 - As part of this graduate course, a computer program is developed in class for the analysis of rectangular plates in bending. In addition, the students made intensive use of MSC-PAL for the analysis of plates in general, as well as the analysis of some special type of shells under static loads.

4. Structural Dynamics, CE 531 - In teaching the graduate course Structural Dynamics, intensive use is made of several programs of MSC-PAL INTRO for the solution of Structural Dynamics problems, such as determination of natural frequencies and the calculation of the response of the structure subjected to externally applied excitations. The students also make intensive use of another package of computer programs in Structural Dynamics developed by the instructor for use in this course.

Since the version MSC-PAL INTRO is limited to 25 degrees of freedom for the solution of an eigenproblem, very often it is necessary to use the static condensation method to reduce the dimension of dynamic problems. For these problems, the students have the opportunity to compare the accuracy of the solutions with the dynamic condensation method of reduction, available in the instructor's programs.

6. Finite Element Structural Analysis Using Microcomputers

The University of Louisville has offered a one-day workshop designed to acquaint participants with the use of MSC-PAL programs. During the workshop, the participants have the opportunity to become familiar with the 12 sample problems included in the User's Manual. As part of the fee for the workshop, the participants receive the MSC-PAL INTRO and a binder with copies of the transparencies used by the instructor in the presentation of the material.

#### CONCLUSIONS

The MSC-PAL C and MSC-PAL INTRO have been used in structural courses, mainly to acquaint students with professionally developed computer programs as well as a check of results obtained by manual computation or by programs developed in class. The students have reported most favorable in their experience using these programs. Instructors find that the use of these programs in their courses is a beneficial experience. However, they also are aware of the limitations imposed by programs already compiled with no access to the source codes. For this reason, these programs can only be useful in checking results obtained independently by the students.