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USE OF NASTRAN IN A UNIVERSITY ENVIRONMENT

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SUMMARY

The heavy use of NASTRAN here and abroad has demonstrated its value as a resource for structural and heat transfer analyses. This paper brings another view of NASTRAN as an educational and research tool in a university. A survey was conducted in the middle of the 1977-78 school year. Each faculty member of the civil engineering, engineering mechanics, and mechanical and aerospace engineering departments was asked to give information on the present (Level 15.5) and future projected (Level 17) usage of NASTRAN program. Results from the survey study are summarized in this paper.

WIDE ACCEPTANCE FROM INDUSTRIES

The NASTRAN systems management office surveyed the user group in May 1974. At that time 2300 users and 5200 CPU hours per month computer time on various NASTRAN activities were reported (ref. 1). These numbers are probably conservative, since not all users responded and not all users got the questionnaire. Besides, many small engineering companies run their NASTRAN jobs through the CDC/CYBERNET or Sperry UNIVAC systems. They find that it is more economical and also more convenient. Wide acceptance of the program from the industry has been observed, and the user community is steadily growing.

IN AN EDUCATIONAL INSTITUTE

One interesting result from the 1974 survey was the large number of non-aerospace users. They account for more than 75 percent of the total computer use. This specific non-aerospace group consists of computer and engineering consulting companies, automobile and manufacturing industries, universities, etc. However, very little information on NASTRAN use was reported from academic institutions. Wilkinson discussed his experiences with incorporation NASTRAN as a teaching tool in undergraduate courses at Louisiana Tech University (ref. 2). He found that most students tend to be overwhelmed by the magnitude and bulk of the NASTRAN user's manual. He proposed that a "Mini-Manual" be made available which describes the essential steps for setting up a NASTRAN job. This has been accomplished by the release of a "Condensed Form of NASTRAN" (ref. 3). It is specifically designed for university instructions and short courses. A more general view of NASTRAN in several of the university's educational and research programs at Rolla campus is presented in this paper.

THE SURVEY

A survey was conducted in several departments of the school of engineering at the end of Fall semester 1977. A questionnaire was sent to each faculty member of the civil engineering, engineering mechanics, and mechanical and aerospace engineering departments. The purpose was to gather information on the usage of NASTRAN programs (Level 15.5) in the school of engineering so that a conclusion could be reached on whether or not to recommend to the office of computing activities the leasing of Level 17 NASTRAN. Responses were obtained from 27 faculty members. The questions being asked were:

1) Courses presently using NASTRAN.

2) Number of graduate students using the program in their theses.

3) Research projects using NASTRAN.

4) Will use Level 17 in courses and/or research work.

The results are presented in the following section.

FINDINGS

NASTRAN program has been incorporated in twelve undergraduate and graduate courses as a supplemental teaching tool. Those courses are:

AE	253	Aerospace Structures
AE	351	Intermediate Aerospace Structures
CE	425	Finite Element Application in Structural Design
CE	428	Matrix Methods of Structural Analysis
EMe	300	Vibration Experiments
EMe	361	Theory of Vibrations
EMe	401	Advanced Topics in Engineering Mechanics
EMe	405	Numerical Methods of Mechanics
EMe	431	Theory of Plates
EMe	432	Theory of Shells
MeAE	300	Special Problems
MeAE	407	Advanced Mechanical Vibrations

Course numbers 399 and below are basically designated for undergraduates, and, 400 and above for graduate courses. Instructors have learned from experience that students with very little computerized structures background are able to readily grasp the program's logic and begin solving realistic problems. This is due to the fact that the program is user oriented with easy input and extensive error checks. Faculty members also indicated interest in using

NASTRAN in thirteen other courses.

The program is also being used as a research tool for graduate students on their thesis work, and for faculty members on various research projects. Thirteen M.S. and Ph.D. theses have used NASTRAN for some part of their analysis. The research problems covered a broad range of engineering areas. Following are examples of research topics:

Interactive Graphics

Analysis of Power Plant Piping Systems

Nonlinear Analysis of Reinforced Concrete Beams

Vibrations of an Airplane Wing

Stress Concentration Factors in Gears

Fracture Analysis of Rocks

Buckling of Cold-Rolled Steel Thin-Wall Structures

Research grants utilizing NASTRAN computations, totaling in excess of $250 K, are currently pending. Faculty members were unanimously in favor of the acquisition of Level 17 NASTRAN instead of the "Condensed Version". Considering the extensive use of NASTRAN by both faculty and students, the choice is obvious. Also, those students with experience using finite element methods and NASTRAN are enjoying a high level of interest from interviewers.

CONCLUDING REMARKS

NASTRAN program has a significant effect on several of the university's education and research programs. They have been described and can be summed up with the following observations:

1. Supplemental teaching tool in many mechanics and structural courses.

2. Graduate students use NASTRAN in their theses.

3. Use in research contracts and projects involving NASTRAN computation.

4. Faculty in favor of Level 17 instead of the "Condensed Version".

5. Some experience with NASTRAN is a definite plus for students seeking employment.

REFERENCES

1. Weidman, Deene J.: NASTRAN Status and Plans. NASTRAN: Users' Experiences. NASA TM X-3278, 1975, pp. 1-10.

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3. Rogers, James L. Jr.; Mei, Chuh; and Brown, W. Keith: A Condensed Form of NASTRAN. NASTRAN: Users' Experiences. NASA CP-2018, 1977, pp. 299-303.