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CONVERSION OF THE PVAST FINITE ELEMENT CODE TO A DREA UNIX COMPUTER PLATFORM

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by
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CONTRACTOR REPORT

Prepared for

Defence Research Establishment Atlantic

Centre de Recherches pour la Défense Atlantique

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ABSTRACT

The marine propeller finite element analysis code PVAST is an important tool which is used at DREA for prediction of propeller stress and vibration. The code was developed for mainframe use on DEC VAX/VMS computers. This report describes the work undertaken to port the PVAST code to an SGI UNIX workstation and to create an X-windows version of the supporting PVAST graphics modules. Test cases used to verify the code operation are included.

RÉSUMÉ

Le code PVAST d'analyse par éléments finis des hélices marines est un outil important utilisé au CRDA pour prévoir les contraintes et les vibrations des hélices. Ce code a été développé pour les gros ordinateurs VAX/VMS DEC. Ce rapport décrit les travaux entrepris afin de porter le code PVAST sur une station de travail UNIX SGI et de créer une version X-windows des modules graphiques utilisés par PVAST. Les cas utilisés pour vérifier le fonctionnement du code sont inclus.

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1. INTRODUCTION

The marine propeller finite element analysis code PVAST [1] is an important analysis tool for the Structural Mechanics Group at the Defence Research Establishment Atlantic (DREA). The code was developed for mainframe use on DEC VAX/VMS computers. In its current form PVAST cannot be compiled or run on UNIX based computers which might eventually replace the current DREA VAX 6400 VMS mainframes. Since the DREA preferred platform for running PVAST is an SGI UNIX workstation, Martec Limited was tasked to produce a UNIX version of the PVAST code to run on an SGI computer.

This report describes the work undertaken to port the PVAST codes to the SGI UNIX workstation and to create an X-windows version of the supporting PVAST graphics modules. Details of this are provided in Section 2. The test cases used to verify the code operation are documented in Section 3 and a summary is provided in Section 4.

2. DESCRIPTION OF TASKS

2.1 Porting PVAST to UNIX Based Computers

Most of the developmental work was performed on RISC based Hewlett-Packard (HP) 700 series workstation available at Martec. The PVAST source codes were transferred to the HP workstation via the FTP file transfer facility. Because of the experience gained by Martec in converting other VAST codes such as VASTG [2] and VASGEN [3], it was relatively easy to port PVAST to the HP. The modifications necessary to make the program run on the UNIX workstation are described below.

a. Calls to the Martec library subroutine FSTAT were modified to calls to FSTATM. This library routine checks, among other things, for the existence of files. The modification was necessary because the "**INQUIRE**" function, employed by FSTAT, did not work properly on RISC-based platforms.

b. Modifications were made to all PVAST modules to ensure that all file opening and closing were done through the Martec library routines SOPEN and SCLOSE, respectively. These library subroutines can take account of the file naming, opening and closing conventions on

UNIX, PC or VAX/VMS based systems automatically. Thus their use ensures that the PVAST codes are portable across the various systems.

c. Previous Martec's experience in porting codes across various platforms has identified problems associated with changing the values of variables initialized in DATA statements, on the UNIX platform. In order to avoid this problem, modifications were made in PVAST modules to initialize those variables by assigned statements.

d. Declaration of two-dimensional character variables were modified from:

CHARACTER STRING*L (M,N)
CHARACTER STRING (M,N)*L

where

STRING	=	character string variable name
L	=	character length
M,N	=	dimensions of the character variable.

The former declaration did not work properly on UNIX platforms.

The code was thoroughly debugged and tested on the HP workstation before being uploaded to the SGI based computer system. However, additional modifications were necessary to produce the SGI version because of differences in FORTRAN compilers and the UNIX operating systems on the two platforms. The most significant modifications were related to background colour definitions on the SGI. Other modifications included the following:

a. The common block name "INTER" was changed to "INTERR" because a subroutine named INTER exists as part of the BLADGM subprogram;

b. The integer array name "MASTER" was changed to "NASTER" in subprogram PVCHL1 because of conflicts in the use of the name "MASTER" in other modules;

c. The program statements were commented out in PVASTM and PPOSTM; and

d. The common block "GENPI" in modules PGLOD1 and PVLODA was split into common blocks named "GENPI" and "GENPC" because the original common block contained both integer and character variables, which the compiler on the SGI system does not permit. In the present form, "GENPI" common block contains only the integer variables whereas the "GENPC" common block contains the character variables only.

2.2 Generation of X-windows Version of PVAST Graphics

The graphics modules of PVAST utilize subroutines from the PLOTVX and PLOTGUI libraries. These libraries have recently been modified to utilize the X-windows/GKS public domain software. The PVAST graphics modules have been linked with PLOTVX and PLOTGUI in the UNIX environment, utilizing XGKS. Several test cases were performed to validate the PVAST UNIX software.

3. EXAMPLES

As stated in the previous section, several test cases have been used to validate the UNIX version of PVAST. Most of the present work deals with the performance of the PVAST graphical user interface and the graphics modules, and hence all the test cases were mainly directed at verifying these aspects of the program. Typical plots of the screens illustrating the graphical user interface and graphical capabilities are provided in Figures 1 to 10.

4. REFERENCES

[1] T.S. Koko, M.W. Chernuka and M.E. Norwood, Propeller Vibration and Stress Analysis by Finite Element Methods, (PVAST) — Version 6.1, User's Manual, April 1995.

[2] M.F. Palmeter and M.W. Chernuka, VASTG: A Graphics Program for the Vibration and Strength Analysis. Program VAST — Version 6.1, User's Manual, July 1995.

[3] J.C. Wallace and M.W. Chernuka, VASGEN: A Finite Element Model Generation Program for VAST — Version 6.1, User's Manual, March 1995.

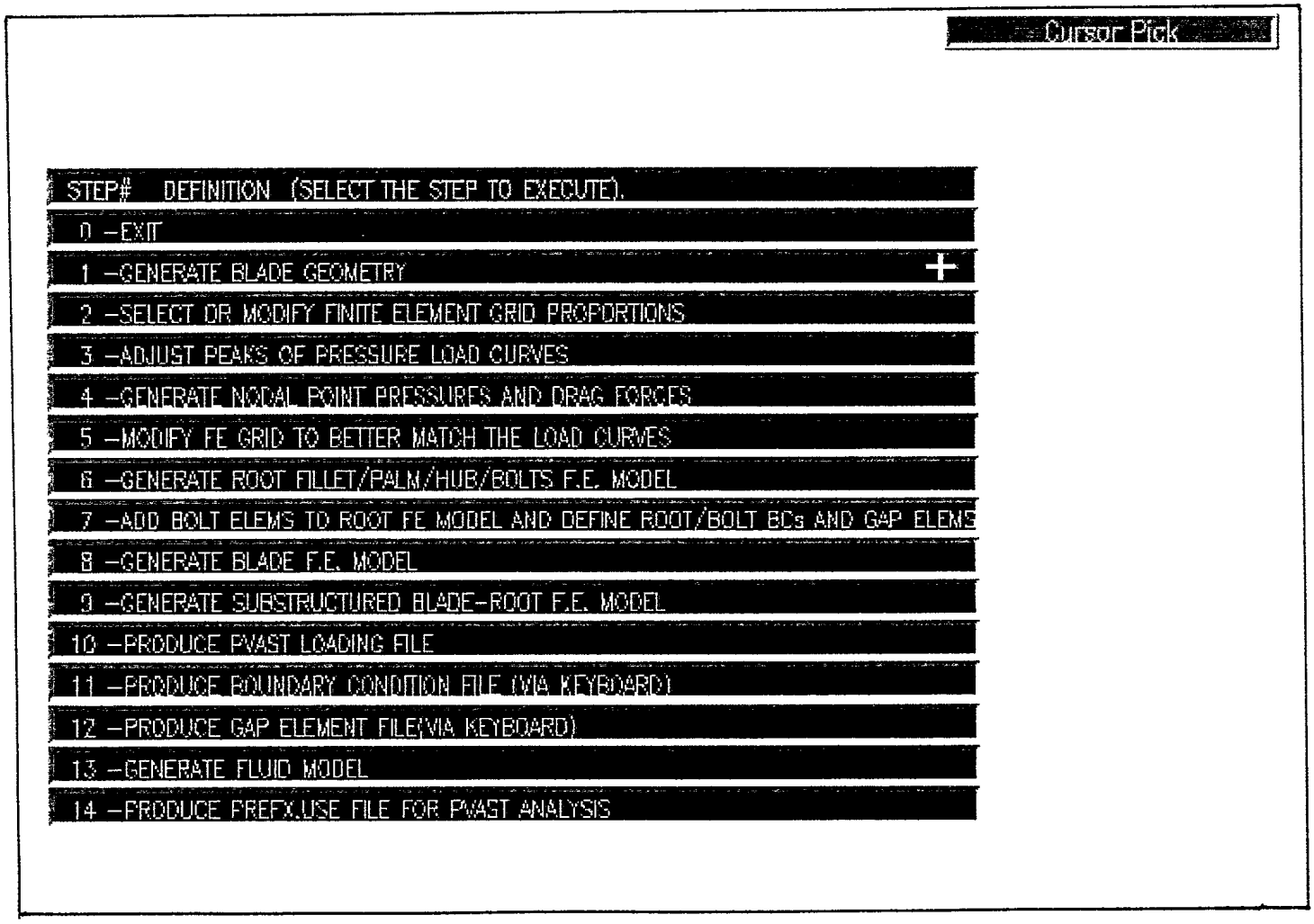

FIGURE 1: Screen Showing PVAST Options

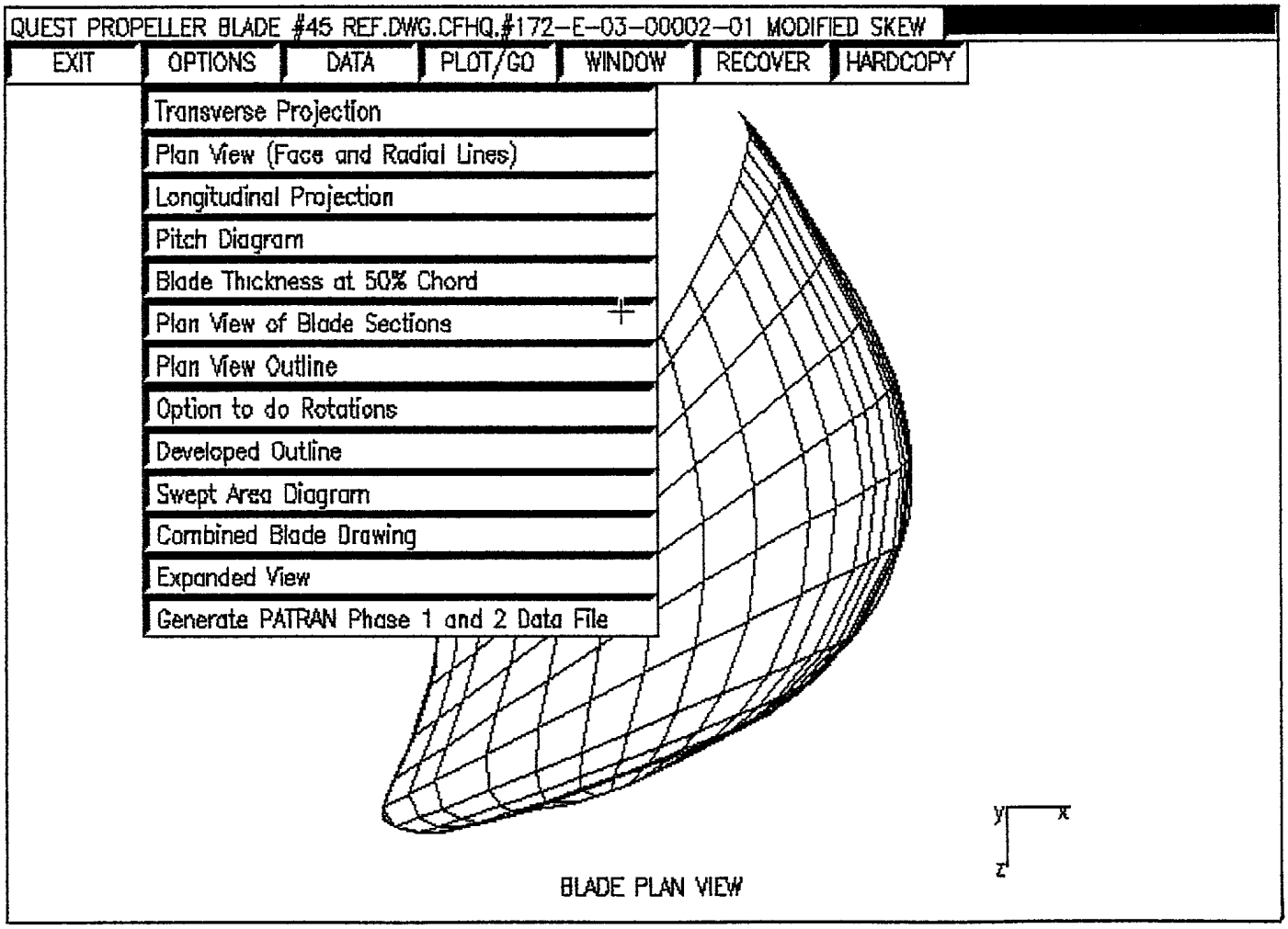

FIGURE 2: Screen Showing Plain View of Blade True Outline With BLADGM Options

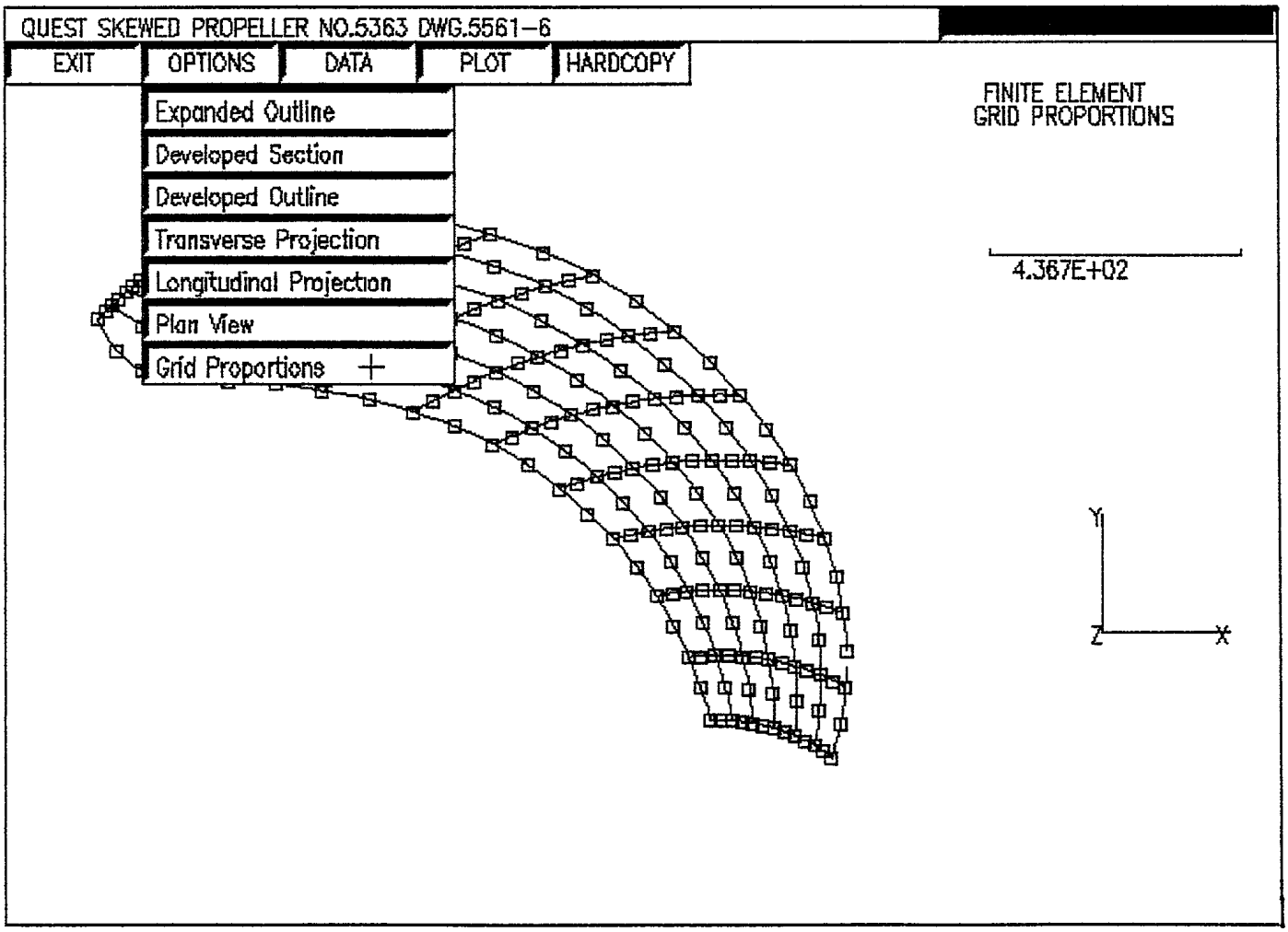

FIGURE 3: Blade Grid Proportions With BLADPL Options

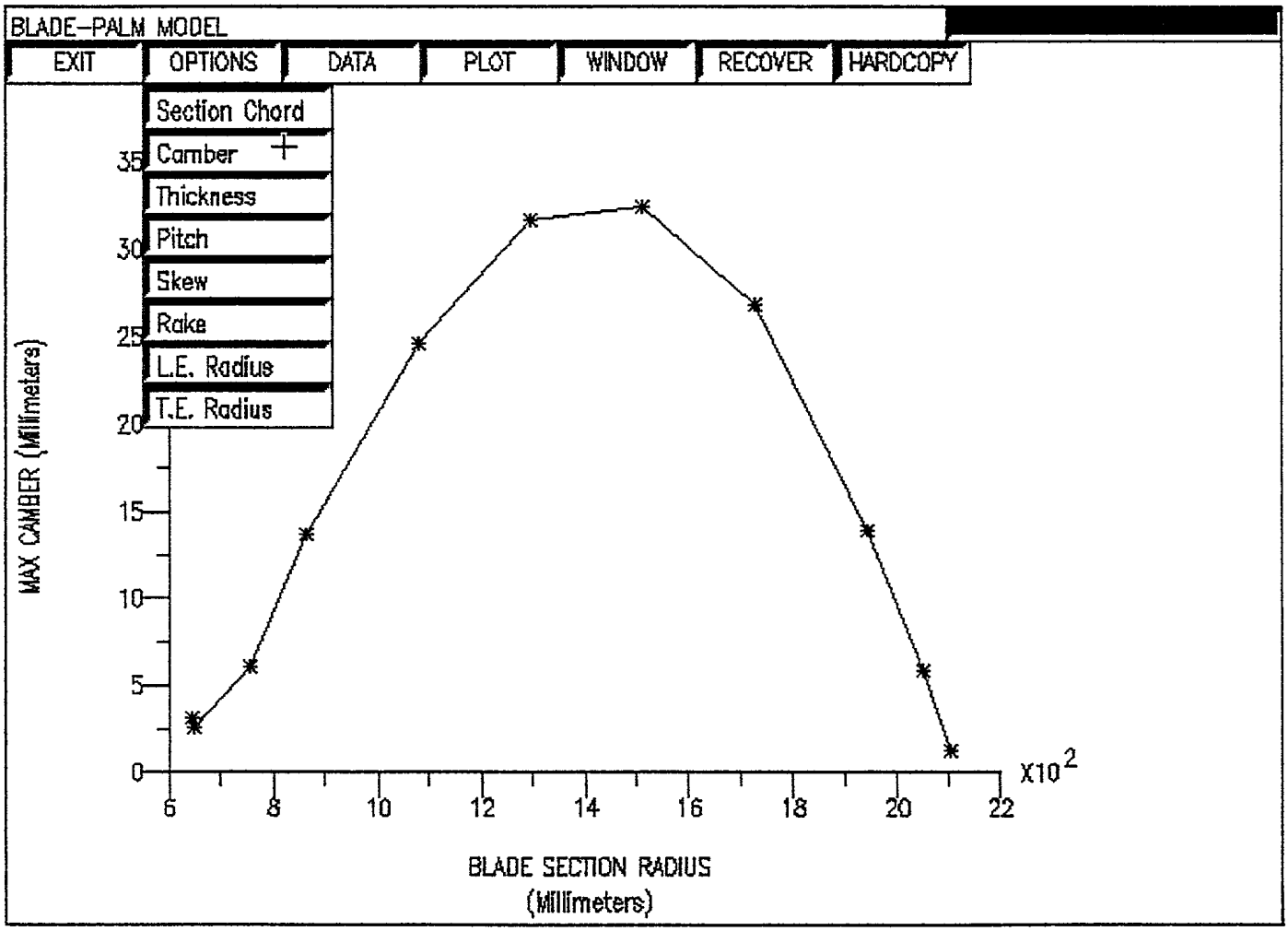

FIGURE 4: Maximum Camber Versus Blade Section Radius

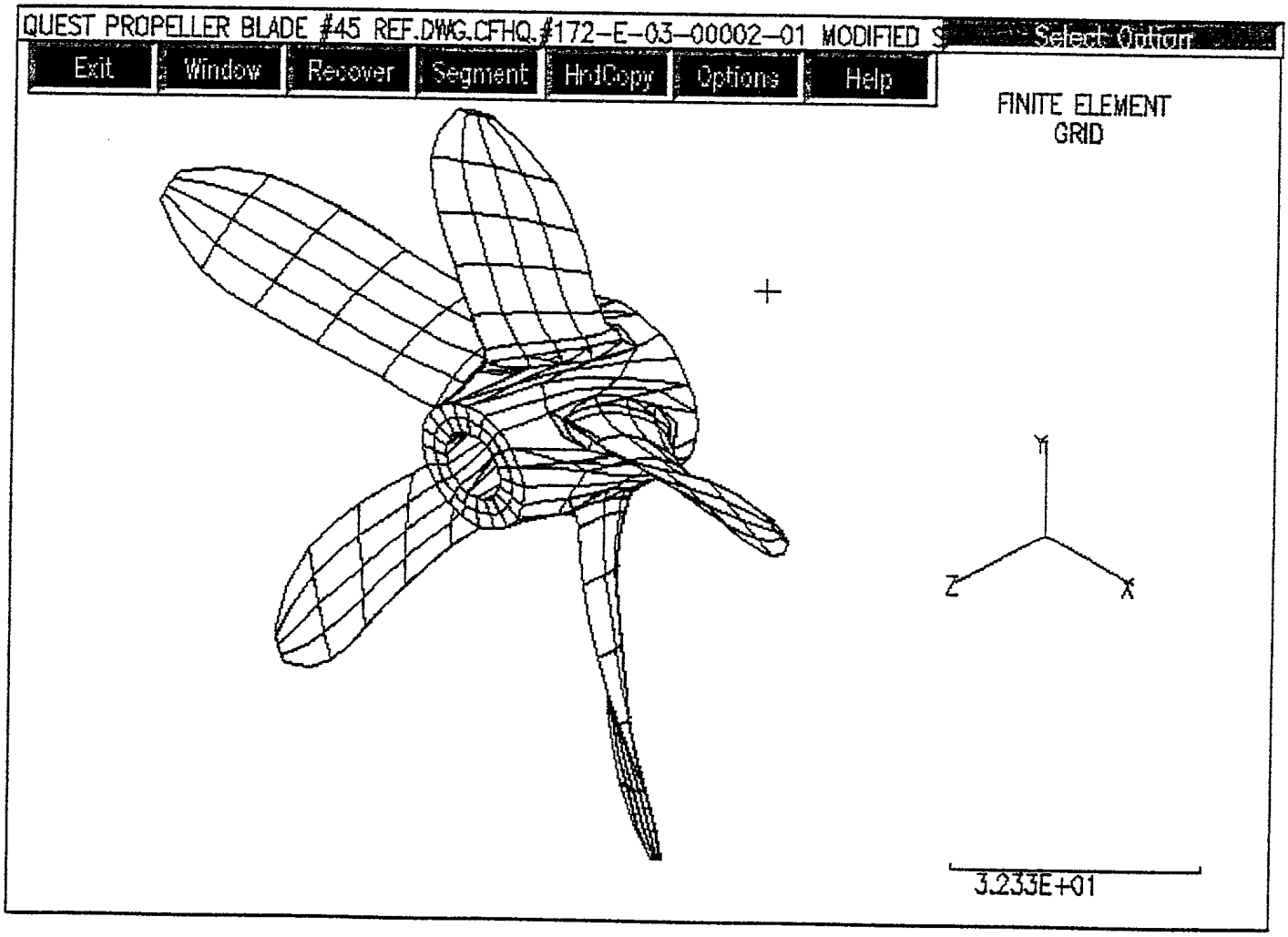

FIGURE 5: Substructured Five Bladed Model

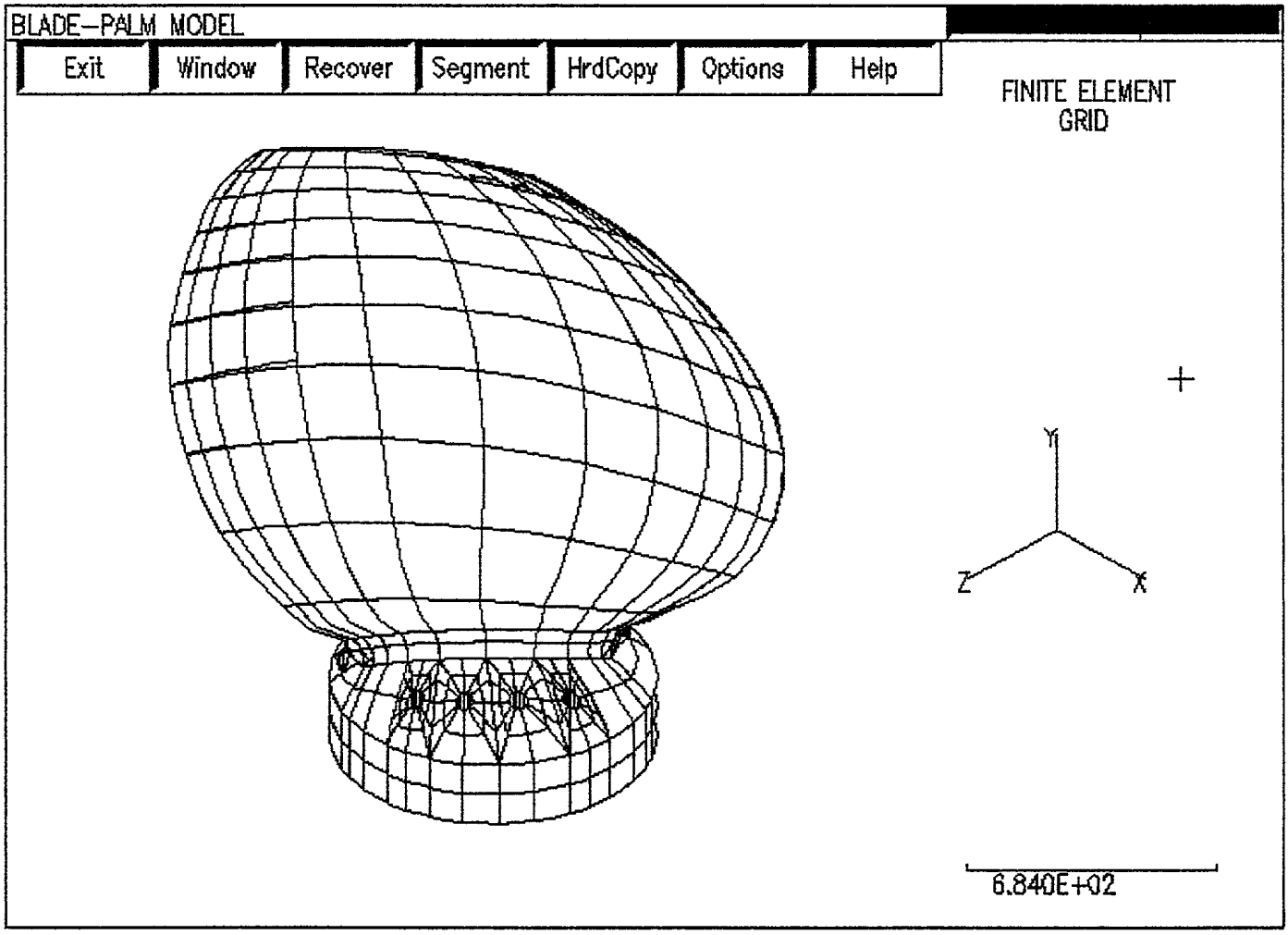

FIGURE 6: Substructured Model of Blade, Fillet, Palm With Bolt Holes

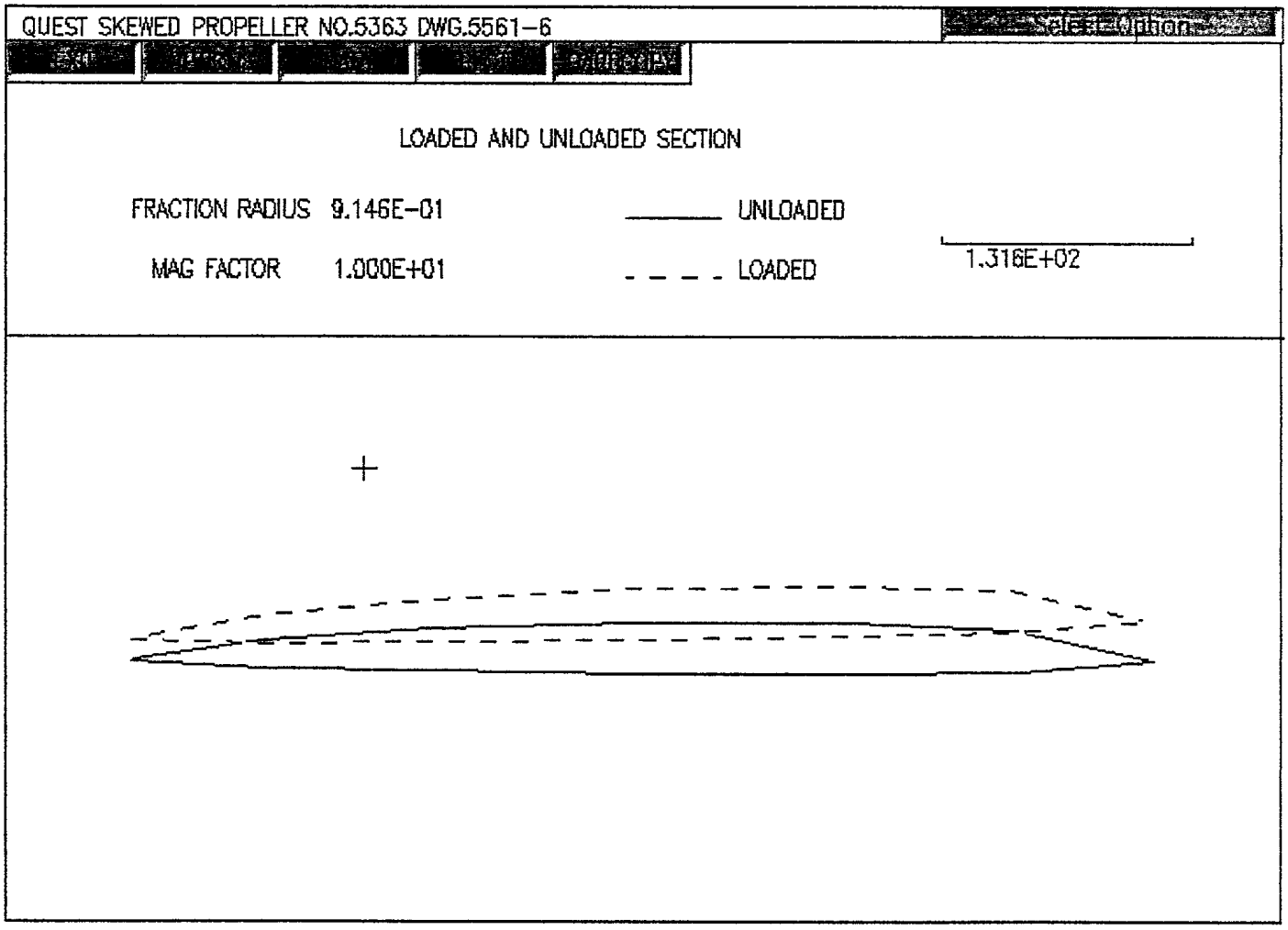

FIGURE 7: Loaded and Unloaded Blade Section

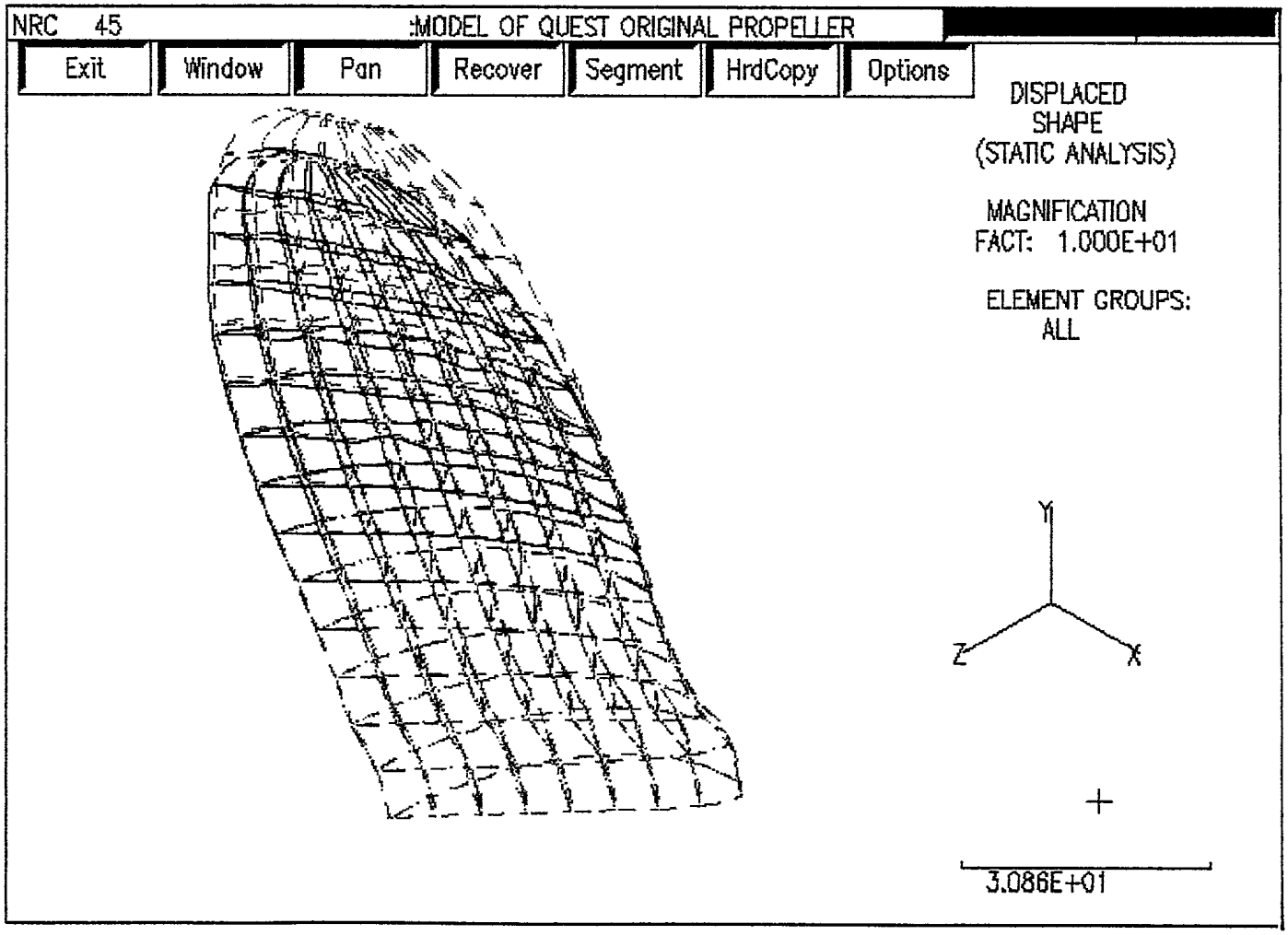

FIGURE 8: Displaced Shape

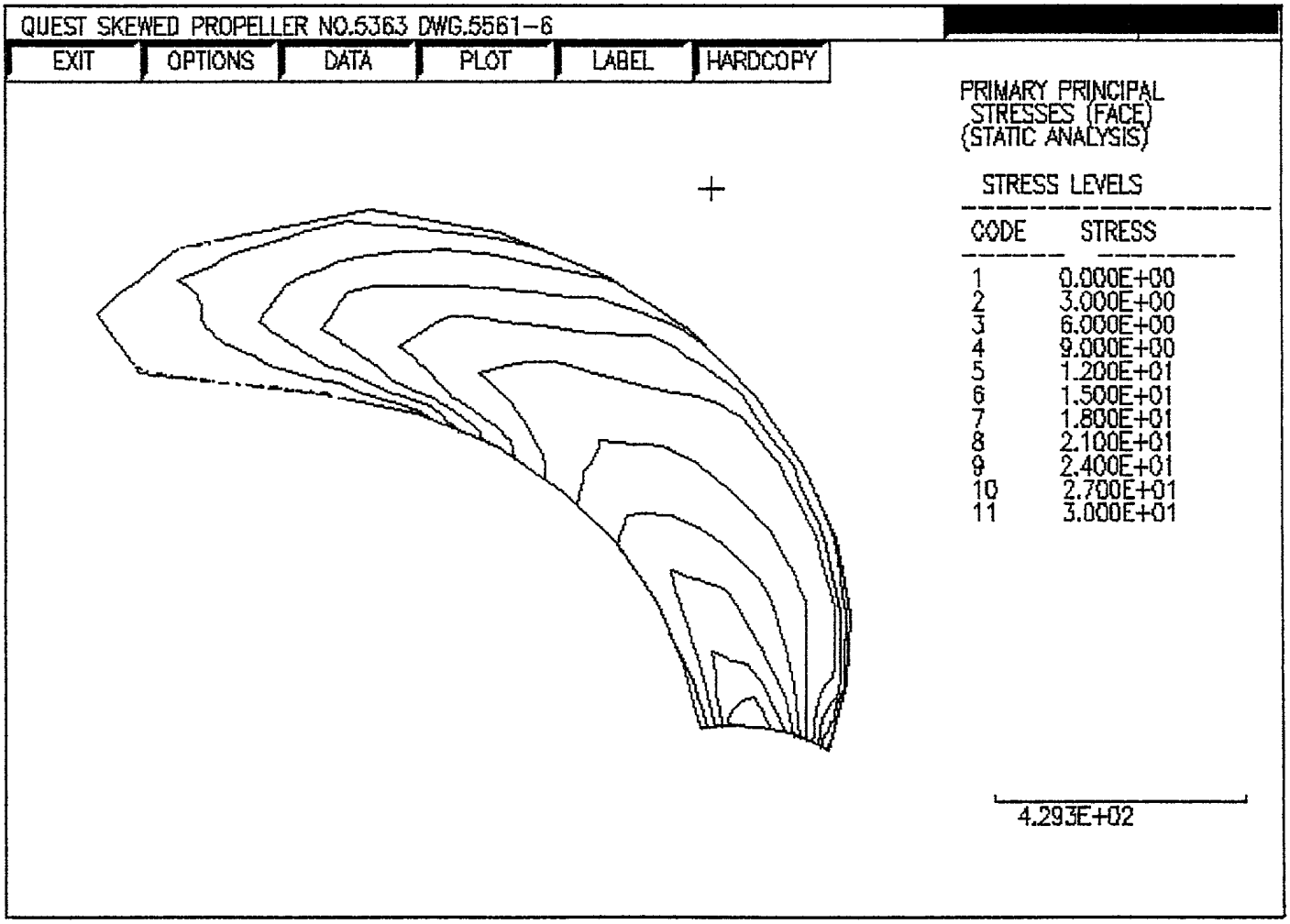

FIGURE 9: Stress Contours

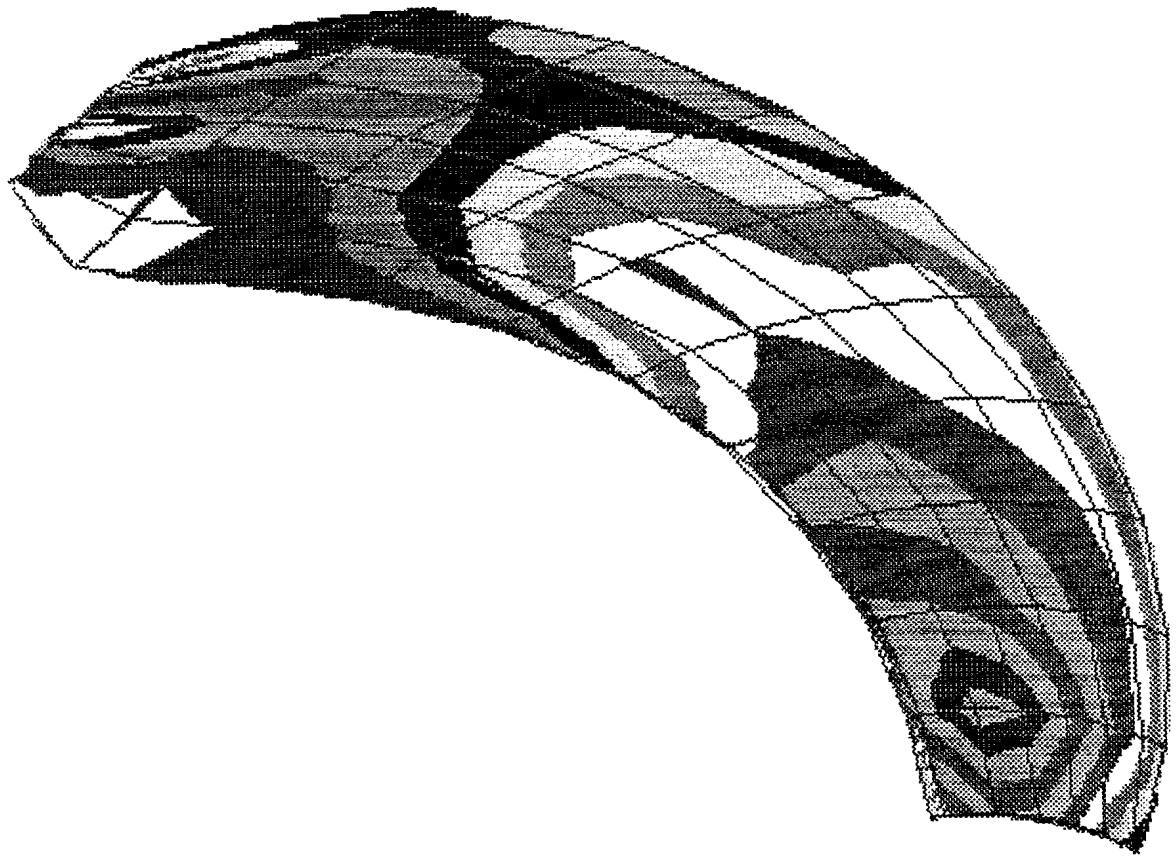

FIGURE 10: Stress Contours Fringe Plot

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