

results of the finite element approximation are grossly incorrect (Fig. 2). The σ_{yy} result varies between 90 and 118 percent of the true solution. The other components, which should be zero, have magnitudes up to 10 percent of the exact σ_{yy} component. (Using the same element formulation for a similar problem, Razzaque [5] reports normal stresses between -153 percent and +156 percent of the nominal values.)

When the problem was solved with square default elements (not shown), the exact solution was obtained.

The three-dimensional (3D) default element (ANSYS Rev. 4.2b element STIF45, KEYOPT(1)=0) also was tested. The results were comparable to the 2D example, so the model is not reported.

Conclusion

The immediate conclusion is that these incompatible elements of ANSYS, SAP and SAPIV should be used with caution, if they are used at all. The danger is that, whenever the elements are not rectangular (or rectangular prisms for 3D), the error in the calculated stresses can be so large that the character of the finite element solution is different from that of the exact solution. In ANSYS Rev. 4.2b, the STIF42, KEYOPT(2)=1 element is a compatible 2D continuum element that passes the patch test. The comparable 3D continuum element is STIF45, KEYOPT(1)=1. It is recommended that these elements be used rather than the default incompatible elements. ANSYS Rev. 4.2b also implements non-default, incompatible, continuum elements that pass the patch test (STIF45, KEYOPT(1)=2 and STIF42, KEYOPT(2)=2, see reference 8). The authors have no recommendation regarding the use of these elements. In the most recent revision of ANSYS (Rev. 4.3) the order of element options and element library have been changed (2). The default elements are now the incompatible elements which do pass the patch test. If the analyst wants to use a standard, compatible element he must explicitly choose the appropriate non-zero element option.

A general conclusion is that elements which do not pass the patch test should never be used. This strong recommendation was the unanimous consensus of a patch test forum [1] organized jointly by MARC Analysis Research Corp., Palo

Alto, CA, 94306 and Professors T. J. R. Hughes and J. C. Simo of Stanford University. The attendees included, Professors O. C. Zienkiewicz, University College of Swansea and R. L. Taylor, University of California at Berkeley.

Special care should be taken with versions of ANSYS prior to Revision 4.3, SAP and SAPIV to avoid possible errors caused by elements which fail the patch test. Use of the patch test is recommended whenever there is any doubt concerning the compatibility of a particular element.

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BIOMCH - L

An Electronic Mail Discussion List for Biomechanics and Kinesiology

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An electronic distribution list has been created for members of the International Society of Biomechanics (ISB) and of related organizations (e.g., European, American, and Canadian Societies of Biomechanics) which, at least for users of EARN/BITNET/NETNORTH systems, allows free exchange of information with fellow-members on the list. In view of the overlap between Biomechanics and other fields such as Kinesiology, Bioengineering, Motor Control, and Physiology, the list is also open to non-members. At the time of writing (January, 1989), there are about 45 known subscribers in Belgium, Canada, Finland, France, Ireland, Italy, Netherlands, United Kingdom, and the United States, plus an unknown number of readers on Usenet, the news posting system for UUCP (Unix-to-Unix CoPy).

Activities on the list include discussions, congress reports, calls for help, calls for papers, and anything else relevant to

the target domain. It is considered correct procedure that summaries of replies received in response to "calls for help" are posted for the benefit of all readers.

Users on EARN/BITNET/NETNORTH may subscribe to the list by electronic mail or by sending one of the following interactive commands (or the equivalent command for their system):

```
VAX with VMS:  SEND LISTSERV@HEARN SUB
                BIOMCH-L <name>
VM/SP:         TELL LISTSERV AT HEARN SUB
                BIOMCH-L <name>
MVS with TSO/E: TRANSMIT HEARN. LISTSERV
                NOPROLOG and enter SUB
                BIOMCH-L <name> <PF3> on
                the screen
```

where <name> should be the user's full name (e.g., initials and last name). When sending the request interactively, it might be advisable to place <name> within double quotes, as in "<name>", since some systems will otherwise convert the text into capitals only.

Messages can be submitted for distribution over the list by sending the message in mail format to BIOMCH-L@HEARN (but NOT to LISTSERV@HEARN!). At present, the list is open for subscription and distribution without editorial interference. Note that EARN/BITNET/NETNORTH imposes

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certain standards as regards non-academic use; see the relevant information which can be obtained from NETSERV-@HEARN or from any other NETSERV fileserver on EARN/BITNET/NETNORTH. In order to protect the subscribers' privacy, their names and electronic addresses cannot be REVIEWed (even though subscription is open to anyone); depending on subscribers' wishes, this policy might be reconsidered.

At present, the list exists merely at the central EARN-node in The Netherlands (HEARN at the University of Nijmegen). Depending on list usage, so-called "peer servers" may be created in other countries so as to reduce long-distance electronic mail expenses. In addition, this would allow use of the option for "local" distribution from one server (e.g., nation-

wide) or for "global" distribution from all servers simultaneously.

To some extent, non-EARN/BITNET/NETNORTH users may communicate via electronic mail messages (but not interactively as in the above examples). If this fails, I shall be happy to enter their electronic addresses in the BIOMCH-L distribution list. Note that use of the facility on other networks (e.g., ARPA/Internet, JANET, UUCP/Eunet) may entail expenses that will be charged to the user.

Readers not familiar with electronic mail and its facilities should refer to their local computer center, or read the paper "Notable Computer Networks" by Quarterman and Hoskins in the *Communications of the ACM*, October, 1986.

I look forward to seeing you in Netland!