TANKER LONGITUDINAL STRENGTH ANALYSIS
USER'S MANUAL AND COMPUTER PROGRAM

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SHIP STRUCTURE COMMITTEE
1972
Dear Sir:

One of the most important goals of the Ship Structure Committee is the improvement of methods for design and analysis of ship hull structures. This report is the second in a sequence of four Ship Structure Committee reports on a project directed toward development of an accurate, but less expensive, computer aided structural analysis method.

This report contains the User's Manual and computer program for the longitudinal strength analysis portion of the program. Other reports of this project are:

SSC-225 - Structural Analysis of Longitudinally Framed Ships

SSC-227 - Tanker Transverse Strength Analysis--User's Manual

SSC-228 - Tanker Transverse Strength Analysis--Programmer's Manual

Comments on this report would be welcomed.

Sincerely,

W. F. Rea, III
Rear Admiral, U. S. Coast Guard
Chairman, Ship Structure Committee
Final Report

on

Project SR-196, "Computer Design of Longitudinally Framed Ships"

to the

Ship Structure Committee

TANKER LONGITUDINAL STRENGTH ANALYSIS
USER'S MANUAL AND COMPUTER PROGRAM

by

R. Nielson, P. Y. Chang, and L. C. Deschamps
COM/CODE Corporation

under

Department of the Navy
Naval Ship Engineering Center
Contract No. N00024-70-C-5219

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U. S. Coast Guard Headquarters
Washington, D. C.
1972
ABSTRACT

This report, the second in a sequence of four Ship Structure Committee Reports on a method for performing structural analysis of a tanker hull, contains the User's Manual and Computer Program for the longitudinal strength analysis portion of the program.
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<th>Page</th>
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</thead>
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<td>1</td>
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<tr>
<td>OUTPUT</td>
<td>4</td>
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<td>EXAMPLE</td>
<td>4</td>
</tr>
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<td>FLOW CHART</td>
<td>6</td>
</tr>
<tr>
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<td>7</td>
</tr>
</tbody>
</table>
SHIP STRUCTURE COMMITTEE

The SHIP STRUCTURE COMMITTEE is constituted to prosecute a research program to improve the hull structures of ships by an extension of knowledge pertaining to design, materials and methods of fabrication.

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Chief, Office of Merchant Marine Safety
U. S. Coast Guard Headquarters

Capt. J. E. Rasmussen, USN
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Naval Ship Engineering Center
Naval Ship Systems Command

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American Bureau of Shipping

The SHIP STRUCTURE SUBCOMMITTEE acts for the Ship Structure Committee on technical matters by providing technical coordination for the determination of goals and objectives of the program, and by evaluating and interpreting results in terms of ship structural design, construction and operation.

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NATIONAL ACADEMY OF SCIENCES
Ship Research Committee
TANKER LONGITUDINAL STRENGTH ANALYSIS:

The computer program for the longitudinal strength analysis is simple and can be used independently to compute the longitudinal stresses and shear forces of the side shells and the longitudinal bulkheads.

Input:

<table>
<thead>
<tr>
<th>Card No.</th>
<th>Description</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Number of transverses (maximum 50), MT</td>
<td>(15)</td>
</tr>
<tr>
<td>2</td>
<td>Type of transverses (JD(I), I=1,MT)</td>
<td>(40I2)</td>
</tr>
<tr>
<td></td>
<td>JD(I) = 1 for web frame</td>
<td></td>
</tr>
<tr>
<td></td>
<td>= 2 for swash bulkhead</td>
<td></td>
</tr>
<tr>
<td></td>
<td>= 3 for oil tight bulkhead</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>$A_s$, $A_b$, $I_s$, $I_b$, $E$, $\mu$, $L$</td>
<td>(7E11.4)</td>
</tr>
<tr>
<td></td>
<td>$A_s$ = cross-sectional area of shell</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$A_b$ = cross-sectional area of longitudinal bulkhead</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$I_s$ = moment of inertia of shell</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$I_b$ = moment of inertia of bulkhead</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$E$ = Young's modulus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\mu$ = Poisson's ratio</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$L$ = length of holds (transverse spacing)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$W_{wt}$, $W_{ct}$, $Z_{s,deck}$, $Z_{s, bottom}$, $Z_{b, deck}$, $Z_{b, bottom}$</td>
<td>(7E11.4)</td>
</tr>
<tr>
<td></td>
<td>$W_{wt}$ = width wing tank</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$W_{ct}$ = width central tank</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$Z_{s, deck}$ = section modulus of shell at deck</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$Z_{s, bottom}$ = section modulus of shell at bottom</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$Z_{b, deck}$ = section modulus of bulkhead at deck</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$Z_{b, bottom}$ = section modulus of bulkhead at bottom</td>
<td></td>
</tr>
</tbody>
</table>
Card No.

5 \[ \text{Aweb}_w, \text{Aswash}_w, \text{Aot}_w \] 

Aweb\(_w\) = Shear area for web frame in wing tank
Aswash\(_w\) = Shear area for swash bulkhead in wing tank
Aot\(_w\) = Shear area for oil-tight bulkhead in wing tank

6 \[ \text{Aweb}_c, \text{Aswash}_c, \text{Aot}_c \] 

Aweb\(_c\) = Shear area for web frame in central tank
Aswash\(_c\) = Shear area for swash bulkhead in central tank
Aot\(_c\) = Shear area for oil-tight bulkhead in central tank

7 \[ \text{Iweb}_w, \text{Iswash}_w, \text{Iot}_w \] 

Iweb\(_w\) = Moment of inertia for web frame in wing tank
Iswash\(_w\) = Moment of inertia for swash bulkhead in wing tank
Iot\(_w\) = Moment of inertia for oil-tight bulkhead in wing tank

8 \[ \text{Iweb}_c, \text{Iswash}_c, \text{Iot}_c \] 

Iweb\(_c\) = Moment of inertia for web frame in central tank
Iswash\(_c\) = Moment of inertia for swash bulkhead in central tank
Iot\(_c\) = Moment of inertia for oil-tight bulkhead in central tank
Card No.  

Format  

9a-9n \( Q_{wt}, Q_{ct}, N \) (one card per hold)*  

\( Q_{wt} \) = Uniform load in wing tank  

\( Q_{ct} \) = Uniform load in central tank  

\( N \) = 1 if either \( Q_{wt} \) or \( Q_{ct} \) are non-zero  

= 0 if there are no loads in this hold  

* There are \( MT+1 \) holds or transverse spans.
Output

The output includes the longitudinal stress, the change of shear forces of the longitudinal members.

Example

The longitudinal analysis for tanker KOCKUMS 520 is used as an example. Results from this calculation are based on the relative loading between loading conditions No. 6 and No. 8. They should not be regarded as the actual stress or shear force for full load condition.

The length units are in centimeters and the weight units are kilograms.

<table>
<thead>
<tr>
<th></th>
<th>shells</th>
<th>longitudinal bulkheads</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+1.3588+06</td>
<td>+2.1546+06</td>
</tr>
<tr>
<td>2</td>
<td>+3.7810+06</td>
<td>+1.0650+06</td>
</tr>
<tr>
<td>3</td>
<td>+1.6282+06</td>
<td>+9.3088+06</td>
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<tr>
<td>4</td>
<td>+3.4024+05</td>
<td>+1.1029+06</td>
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<tr>
<td>5</td>
<td>+1.4088+06</td>
<td>+1.9352+06</td>
</tr>
<tr>
<td>6</td>
<td>+1.4012+06</td>
<td>+6.1027+05</td>
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<tr>
<td>7</td>
<td>+3.2907+06</td>
<td>+1.4258+05</td>
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<td>8</td>
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<td>+9.2301+05</td>
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<tr>
<td>9</td>
<td>+5.3476+05</td>
<td>+2.4285+06</td>
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<tr>
<td>10</td>
<td>+2.3566+06</td>
<td>+9.4220+05</td>
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<tr>
<td>11</td>
<td>+2.4936+06</td>
<td>+7.7523+05</td>
</tr>
<tr>
<td>12</td>
<td>+1.5740+05</td>
<td>+3.1214+06</td>
</tr>
<tr>
<td>13</td>
<td>+2.5121+06</td>
<td>+7.6910+05</td>
</tr>
<tr>
<td>14</td>
<td>+2.3513+06</td>
<td>+9.0529+05</td>
</tr>
<tr>
<td>15</td>
<td>+8.0845+05</td>
<td>+2.5358+06</td>
</tr>
<tr>
<td>16</td>
<td>+2.3083+06</td>
<td>+9.2196+05</td>
</tr>
<tr>
<td>17</td>
<td>+2.3349+06</td>
<td>+9.6423+05</td>
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<tr>
<td>18</td>
<td>+8.3975+05</td>
<td>+2.4467+06</td>
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<td>+2.2728+06</td>
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</tr>
<tr>
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<td>+2.9010+06</td>
<td>+1.0946+06</td>
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<td>21</td>
<td>+3.2625+06</td>
<td>+5.7042+05</td>
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<tr>
<td>22</td>
<td>+4.3985+06</td>
<td>+5.1984+06</td>
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<td>+4.4545+06</td>
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<td>+4.5099+06</td>
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<tr>
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<td>+2.7142+06</td>
</tr>
<tr>
<td>28</td>
<td>+4.0454+06</td>
<td>+4.4122+06</td>
</tr>
<tr>
<td>29</td>
<td>+3.9623+06</td>
<td>+5.9474+06</td>
</tr>
</tbody>
</table>
**INPUTS FOR THE PRIMARY STRENGTH**

LENGTH E ONU AND THE WIDTH OF THE TANKS

- .1510+05
- .2050+07
- .3660+00
- .1388+04
- .1126+04
- .1605+08
- .1468+08

AREAS AND I. OIU OF THE LONG BIRDS & SHELLS

- .5982+04
- .3906+04
- .2164+11
- .1985+11
- .1944+08
- .1636+08

AREAS OF THE TRANSVERSES.... .6636+03

MOMENT OF INERTIA OF THE TRANSVERSES

- .5925+10
- .6506+10
- .6060+10
- .5560+10
- .6130+10
- .6330+10

**BENDING MOMENT AND STRESSES**

<table>
<thead>
<tr>
<th></th>
<th>Ms</th>
<th>σd</th>
<th>σb</th>
<th>Mx</th>
<th>σd</th>
<th>σb</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**UNIFORM LOADS OF THE TRANSVERSES**

<table>
<thead>
<tr>
<th>Ms</th>
<th>σd</th>
<th>σb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ms = Bending moment of the shells
Mx = Bending moment of the longitudinal bulkheads
σd = Stress on deck
σb = Stress on bottom
Flow Chart.

INPUT

Deflection of longitudinals without support

Influence coefficients

Adjusted loads

Deflection and influence coefficients of transverses

Stiffness matrix

Reactions at the Intersections

Bending moment and stresses

End
PROGRAM CONROUTPUT
DIMENSION A(3,21),Y(50,2),A(50,50), M(50,50)
DIMENSION I(3,21),J(50),T(50)
READ (5,483) M
WRITE (6,484)
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C A1,A2,...,AREA OF THE SHELLS AND THE LONGITUDINAL BULKHEADS
C X1,X2,...,MOMENT OF INERTIA OF THE SHELLS AND BULKHEADS
C ZLEN,...,LENGTH OF THE HOLDS
C Y1,Y2,...,WIDTH OF THE WING AND CENTRAL TANKS
READ (5,483) I, J, M, X, E, G, U, ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
C A1,A2,...,AREA OF THE WEB FRAMES, SWASH BULKHEADS AND OIL-
C TIGHT BULKHEADS
READ (5,483) I, J, M, X, E, G, U, ZLEN
WRITE (6,485)
C Y1,Y2,...,MOMENT OF INERTIA OF THE WEB FRAMES, SWASH BULKHEADS,
C AND OIL-TIGHT BULKHEADS
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C UNIFORM LOADS OF THE TRANSVERSES
READ (5,483) I, J, M, X, E, G, U, ZLEN
WRITE (6,485)
C UNIFORM AND CONCENTRATED LOADS ON THE SPACINGS
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,QUICKSILVER AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,COARSE AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,FINE AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,SILVER AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,PLATINIUM AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,TUNGSTEN AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,NICKEL AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,TITANIUM AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,ALUMINUM AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,SILICON AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,CARBON AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,HYDROGEN AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,HELIUM AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,LITHIUM AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,BORON AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,NITROGEN AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,OXYGEN AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,FLOURINE AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,CHLORINE AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,BROMINE AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,SODIUM AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,MAGNESIUM AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,ALUMINUM AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,SILICON AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,ARSENIC AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,PHOSPHORUS AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,SULPHUR AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,BROMINE AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,SODIUM AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,MAGNESIUM AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,ALUMINUM AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,SILICON AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,ARSENIC AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,PHOSPHORUS AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
C ADD A1,A2,...,SULPHUR AND ZLEN
READ (5,483) A, I, J, X, E, G, U, ZLEN
WRITE (6,485)
IF (I,iEQ,2) GO TO 225
DO 4 J=1,MT
Q(I,J)=0.
4 DO J=1,MT
WRITE (6,226) X(I,I),AF(I,J)*DY(I,J)
WRITE (6,226) MT
DO 227 1=1,MT
WRITE (6,99) (Q(I,1),I=1,2)
DO 10 J=1,MT
WRITE (6,99) (D(I,J),I=1,MT)
10 CONTINUE
DO 20 J=1,MT
J=J0(I)
A1=A(I,J)
A2=A(J,J)
B1=Y(I,J)
B2=Y(J,J)
Q1=Q(I,J)*Y1
Q2=Q(J,J)*Y2
CALL DCE681,B2,A1,A2,Y1,Y2,R1,R2,XK,XD,TD
D(I)=XD
WRITE (6,33) (D(I),I=1,MT)
DO 18 J=1,MT
AE(I,J)=AE(I,J)+AF(I,J)
IF (I,JNE,1) GO TO 18
18 CONTINUE
DO 20 J=1,MT
AE(I,J)=AE(I,J)
20 CONTINUE
WRITE (6,102) (AE(I,J),I=1,MT)
STOP
DO 30 J=1,MT
IF (NH.EQ,1) GO TO 301
R(I,J)=0.
IF (NH.EQ,1) GO TO 301
T(I,J)=Q(I,J)*Q(J,J)
GO TO 40
30 CONTINUE
31 CONTINUE
32 CONTINUE
33 CONTINUE
34 CONTINUE
35 CONTINUE
36 CONTINUE
37 CONTINUE
38 CONTINUE
39 CONTINUE
40 CONTINUE
41 CONTINUE
42 CONTINUE
43 CONTINUE
44 CONTINUE
45 CONTINUE
46 CONTINUE
47 CONTINUE
48 CONTINUE
49 CONTINUE
50 CONTINUE
51 CONTINUE
52 CONTINUE
53 CONTINUE
54 CONTINUE
55 CONTINUE
56 CONTINUE
57 CONTINUE
58 CONTINUE
59 CONTINUE
60 CONTINUE
61 CONTINUE
62 CONTINUE
63 CONTINUE
64 CONTINUE
STOP
SUBROUTINE MULT(D, B, C, DIMENSION BIM, MI, C(M, MI, DIM*H))
    DO 1 I=1, M
        DO J=1, M
            D(I, J) = 9.
    DO 1 K=1, M
        1 D(I, J) = D(I, J) + B(I, K)*C(K, J)
    CONTINUE
    RETURN
END

SUBROUTINE EQUA(A, B, M)
    DO 1 I=1, M
        DO J=1, M
            A(I, J) = B(I, J)
    CONTINUE
    RETURN
END

SUBROUTINE DFCO(X, Y, A1, A2, A, C, Q1, Q2, XK, XD)
    CALL TM(A1, X, A, Q1, T1, N, H1)
    CALL TM(A2, Y, C, Q2, T2, N, M)
    CALL MLILT IT, T2, T1, N
    N=N+1
    GOTO 1

    3 XK=X
    RETURN
END

SUBROUTINE TM(A, XI, A, Q, T, P)
    DO 1 I=1, 5
        T(I, 2) = -A
        T(I, 3) = -A*A/2. /E1
        T(I, 4) = -A**3/6. /E1
        T(I, 5) = 3*A**4/2 +/E1
    E=3079070000.
    G=2*1.3
    AG=1.6
    T(4, 5)=1.
    T(5, 5)=1.
    T(4, 3)=G/2./EI
    T(4, 4)=4.*G/2./EI
    T(4, 5)=G*G/2./EI
    T(3, 5)=G*G/2.
    T(3, 3)=1.
    T(1, 1)=A
    T(1, 2)=0.
    T(1, 3)=0.
    T(1, 4)=0.
    T(1, 5)=0.
    IF (M(1) EQ 0) GO TO 2

    2 CONTINUE
    RETURN
END

   END
INITIALIZATION

N=N
N=M
DETERM=1.0E+08
DO 20 J=1,N
20 INDEX(J,3)=0
DO 33 M=1,N

SEARCH FOR PIVOT ELEMENT

AMAX=0.0
DO 50 K=1,N
IF(INDEX(K,3)=1)60,10,50
50 DO 60 K=1,N
IF(INDEX(K,3)=1)60,10,70
60 IF (AMAX-ABS(A(K,K))>85,.100,100)
55 IRON=J
ICOLUM=K
AMAX=ABS(A(J,K))
100 CONTINUE
105 CONTINUE
INDEX(ICOLUM,3)=INDEX(ICOLUM,3)+1
INDEX(J,1)=IRA
INDEX(J,2)=ICOLUM

INTERCHANGE ROWS TO PUT PIVOT ELEMENT ON DIAGONAL

IF (IR=IROW=ICOLUM)140,310,140
140 DETERM=DETERM
DO 200 L=1,N
SWAP(A(IROW,L),A(IR,R))
200 AICOLUM,L)=SWAP
IPIV=310,310,310,210
210 DO 350 L=1,M
SWAP(AICOLUM,L),BIR=ICOLUM,L)
350 BICOLUM,L)=SWAP
370 CONTINUE

DIVIDE PIVOT ROW BY PIVOT ELEMENT

310 PIVOT=AICOLUM,ICOLUM
DETERM=DETERM/PIVOT
330 AICOLUM=ICOLUM/.0
DO 350 AICOLUM,L)=AICOLUM,L)/PIVOT
350 IF(M)310,310,350
370 CONTINUE

REDUCE NON-PIVOT ROWS

330 DO 350 L=1,N
IF(L=IINDEX(L,1))400,550,400
400 T=IINDEX(L)
A(L,INDEX(L,1))=A(L,INDEX(L,1))/T
450 DO 450 L=1,N
IF(L=IINDEX(L,1))450.450,450
450 A(L,INDEX(L,1))=A(L,INDEX(L,1))/T
490 CONTINUE
530 CONTINUE

INTERCHANGE COLUMNS

DO 700 L=1,N
IF(INDEX(L,1))700,710,650
650 JROW=INDEX(L,1)
JCOLUM=INDEX(L,2)
DO 700 K=1,N
SWAP(AK/JROW),AK/JCOLUM)
700 CONTINUE

CONTINUE
710 CONTINUE
720 CONTINUE
DO 730 K=1,N
910 RETURN
710 ID=1
715 ID=2
GO TO 100
END
This report, the second in a sequence of four Ship Structure Committee Reports on a method for performing structural analysis of a tanker hull, contains the User's Manual and Computer Program for the longitudinal strength analysis portion of the program.
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