
WORKSHOP PROBLEM 3

Rigid Body Check

Objectives:

- Perform a simple rigid body check.

Procedure:

1. Write a DMAP to perform strain free rigid body check.
2. The reaction = $[K]*[U_r]$, where $[U_r]$ is the rigid body vector.
3. Strain = $0.5*[U_r]^T*[K]*[U_r]$.
4. Use the model input file on page 3-2 to test the DMAP.

Hints:

- Use VECPLOT to generate the rigid body vectors.
- Other possible useful modules for this problem include:
 - TRNSP
 - MPYAD
 - ADD
 - MESSAGE
 - MATPRN

Model Input File for Modification:**wkshp3.dat**

```

SOL      101
TIME     5
diag 8
$
$      (INSERT DMAP HERE)
$
CEND
TITLE = Over constrain check
LOAD = 100
SPC = 10
DISP = ALL
$
BEGIN BULK
$
GRID     1      0      0.0      0.0      0.0      0
GRID     2      0      10.      0.0      0.0      0
GRID     3      0      20.      0.0      0.0      0
GRID     30     1      20.      0.0      0.0      1
$
CORD2R   1      0.      0.      0.      0.      1.      0.
        1.      0.      0.
CBAR     1      1      1      2      1.
CBAR     2      1      2      3      1.
CELAS2   999    10.      3      2      30      2
$
PBAR     1      1      10.      50.      100.      50.
MAT1     1      1.+7      .3      .1
$
SPC1     10     123456  1      30
FORCE    100    3      10.      0.      0.      -1.
PARAM    USETPRT 1
PARAM    WTMASS  0.00259
$
ENDDATA

```

Solution Input File:

soln3.dat

```

SOL      101
TIME     5
diag     8
compile  semg
$
alter 'kjjz.*stiffness' $
vecplot  , , bgpdts, eqexins, cstms, , , , /rigid///4 $
trnsp   rigid/rigidt $
mpyad   kjjz, rigidt, /reacg $
message // 'reacg is the reactions -- K * Urigid '
matprn  reacg// $
mpyad   rigid, reacg, /straine $
add     straine, /strain/(0.5,0.) $
message // 'STRAIN ENERGY' $
matprn  strain// $
$
CEND
TITLE = Over constrain check
LOAD = 100
SPC = 10
DISP = ALL
$
BEGIN BULK
$
GRID    1      0      0.0    0.0    0.0    0
GRID    2      0      10.    0.0    0.0    0
GRID    3      0      20.    0.0    0.0    0
GRID    30     1      20.    0.0    0.0    1
$
CORD2R  1      0.      0.      0.      0.      0.      1.      0.
      1.      0.      0.
CBAR    1      1      1      2      1.
CBAR    2      1      2      3      1.
CELAS2  999    10.    3      2      30     2
$
PBAR    1      1      10.    50.    100.   50.
MAT1    1      1.+7    .3     .1
$
SPC1    10     123456  1      30
FORCE   100    3      10.    0.     0.     -1.
PARAM   USETPRT 1
PARAM   WTMASS  0.00259
$
ENDDATA

```

Comparison of Results:

Compare the results obtained in the .f06 file with the results below:

```

^^^ REACG IS THE REACTIONS -- K * URIGID
1 OVER CONSTRAIN CHECK
...
0
0 MATRIX REACG (GINO NAME 101 ) IS A DB PREC 6 COLUMN X 24 ROW RECTANG MATRIX.
OCOLUMNS 1 THRU 14 THRU 20
OCOLUMN 2 ROWS 14 THRU 20
ROW
14) 1.0000D+01 0.0000D+00 0.0000D+00 0.0000D+00 0.0000D+00 -1.0000D+01
OCOLUMN 3 ROWS 14 THRU 20
ROW
14) 1.0000D+01 0.0000D+00 0.0000D+00 0.0000D+00 0.0000D+00 -1.0000D+01
OCOLUMNS 4 THRU 14 THRU 20
OCOLUMN 5 ROWS 14 THRU 20
ROW
14) -2.0000D+02 0.0000D+00 0.0000D+00 0.0000D+00 0.0000D+00 2.0000D+02
OCOLUMN 6 ROWS 14 THRU 20
ROW
14) 2.0000D+02 0.0000D+00 0.0000D+00 0.0000D+00 0.0000D+00 -2.0000D+02
OTHE NUMBER OF NON-ZERO TERMS IN THE DENSEST COLUMN = 2
OTHE DENSITY OF THIS MATRIX IS 5.56 PERCENT.
^^^STRAIN ENERGY
1 OVER CONSTRAIN CHECK
...
0
0 MATRIX STRAIN (GINO NAME 101 ) IS A DB PREC 6 COLUMN X 6 ROW SQUARE MATRIX.
OCOLUMNS 1 THRU 14 THRU 20
OCOLUMN 2 ROWS 2 THRU 6
ROW
2) 5.0000D+00 5.0000D+00 0.0000D+00 -1.0000D+02 1.0000D+02
OCOLUMN 3 ROWS 2 THRU 6
ROW
2) 5.0000D+00 5.0000D+00 0.0000D+00 -1.0000D+02 1.0000D+02
OCOLUMNS 4 THRU 14 THRU 20
OCOLUMN 5 ROWS 2 THRU 6
ROW
2) -1.0000D+02 -1.0000D+02 0.0000D+00 2.0000D+03 -2.0000D+03
OCOLUMN 6 ROWS 2 THRU 6
ROW
2) 1.0000D+02 1.0000D+02 0.0000D+00 -2.0000D+03 2.0000D+03
OTHE NUMBER OF NON-ZERO TERMS IN THE DENSEST COLUMN = 4
OTHE DENSITY OF THIS MATRIX IS 44.44 PERCENT.
1 OVER CONSTRAIN CHECK

```

```

...
0
    U S E T   D E F I N I T I O N   T A B L E   ( I N T E R N A L   S E Q U E N C E ,   C O L U M N   S O R T )
    -----
    INT DOF  INT GP.  EXT GP.  DOF  SB  SG  L  A  F  N  G  R  O  S  M  E  INT DOF
    -----
    1-      1 G      1-      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
    2-      2      -      2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
    3-      3      -      3  3  3  3  3  3  3  3  3  3  3  3  3  3  3  3
    4-      4      -      4  4  4  4  4  4  4  4  4  4  4  4  4  4  4  4
    5-      5      -      5  5  5  5  5  5  5  5  5  5  5  5  5  5  5  5
    6-      6      -      6  6  6  6  6  6  6  6  6  6  6  6  6  6  6  6
    7-      2 G      2-      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
    8-      2      -      2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
    9-      3      -      3  3  3  3  3  3  3  3  3  3  3  3  3  3  3  3
    10-     4      -      4  4  4  4  4  4  4  4  4  4  4  4  4  4  4  4
    11-     5      -      5  5  5  5  5  5  5  5  5  5  5  5  5  5  5  5
    12-     6      -      6  6  6  6  6  6  6  6  6  6  6  6  6  6  6  6
    13-     3 G      3-      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
    14-     2      -      2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
    15-     3      -      3  3  3  3  3  3  3  3  3  3  3  3  3  3  3  3
    16-     4      -      4  4  4  4  4  4  4  4  4  4  4  4  4  4  4  4
    17-     5      -      5  5  5  5  5  5  5  5  5  5  5  5  5  5  5  5
    18-     6      -      6  6  6  6  6  6  6  6  6  6  6  6  6  6  6  6
    19-     4 G      4 G      30-  1  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7
    20-     2      -      2  2  2  2  2  2  2  2  2  2  2  2  2  2  2  2
    21-     3      -      3  3  3  3  3  3  3  3  3  3  3  3  3  3  3  3
    22-     4      -      4  4  4  4  4  4  4  4  4  4  4  4  4  4  4  4
    23-     5      -      5  5  5  5  5  5  5  5  5  5  5  5  5  5  5  5
    24-     6      -      6  6  6  6  6  6  6  6  6  6  6  6  6  6  6  6
    -----
    INT DOF  INT GP.  EXT GP.  DOF  SB  SG  L  A  F  N  G  R  O  S  M  E  INT DOF
    -----
    ----- C O L U M N   T O T A L S -----
    12      0      0      12  24  24  24  24  24  24  24  0  0  12  0  0
  
```