

ANEXO 1

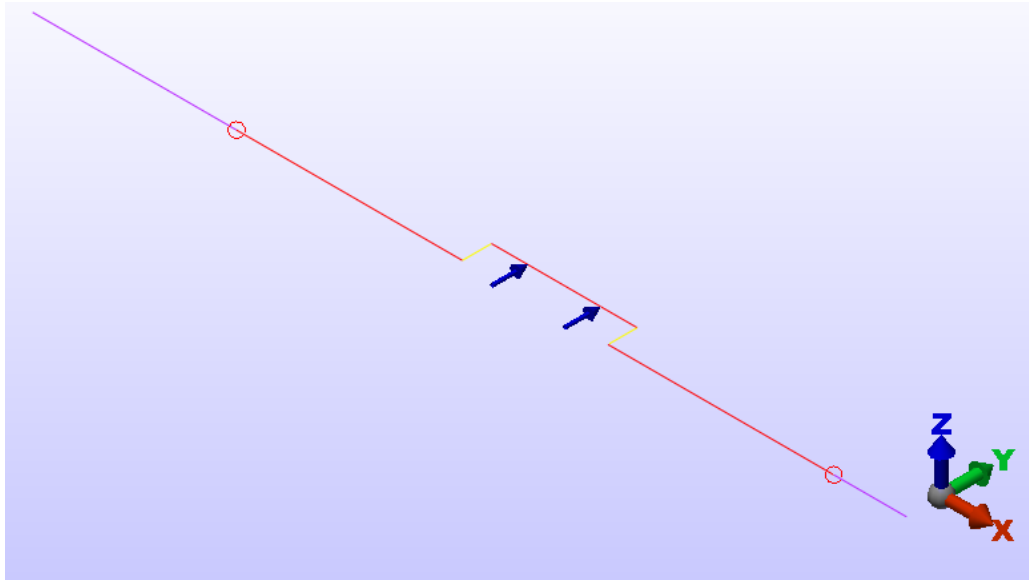


Fig. 1: DCL del eje excentrico del Alimentador Vibratorio.

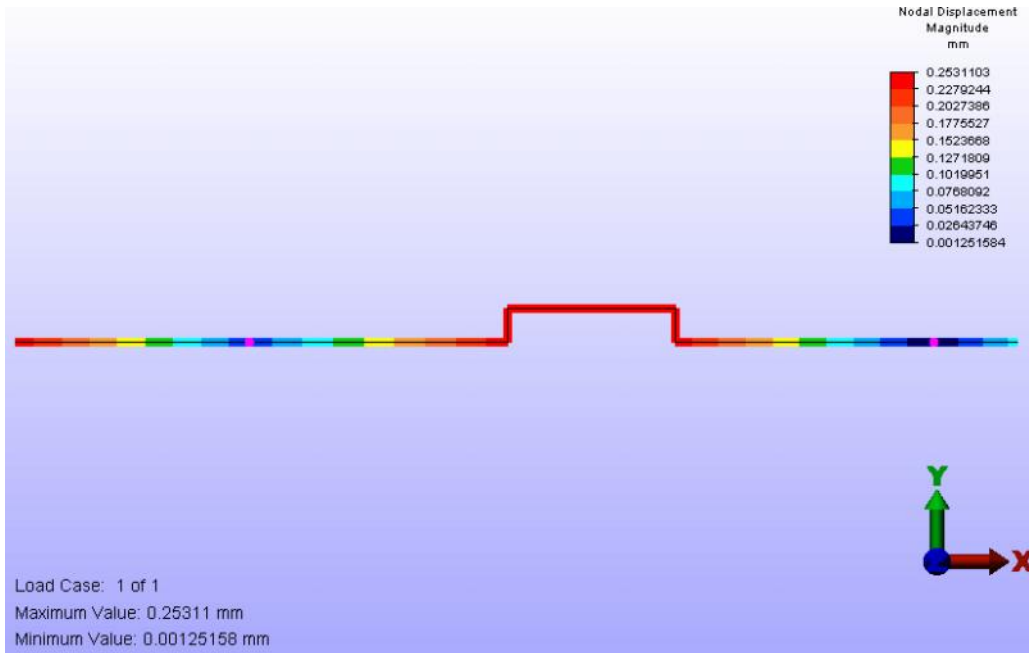


Fig. 2: Desplazamiento del eje excéntrico del Alimentador Vibratorio.

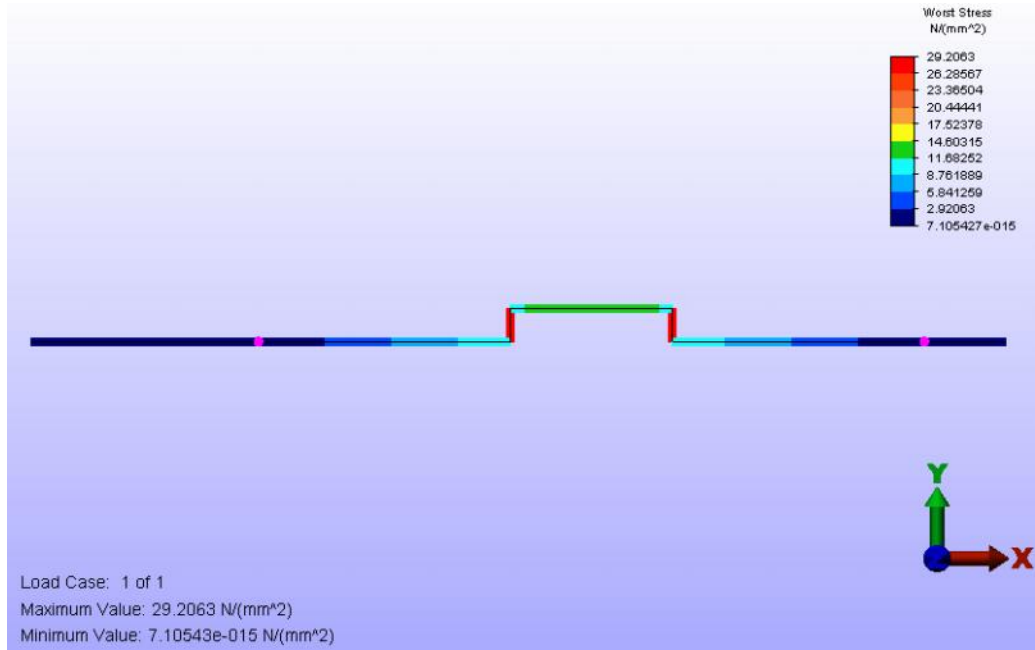


Fig. 3: Esfuerzo del eje excéntrico del Alimentador Vibratorio.

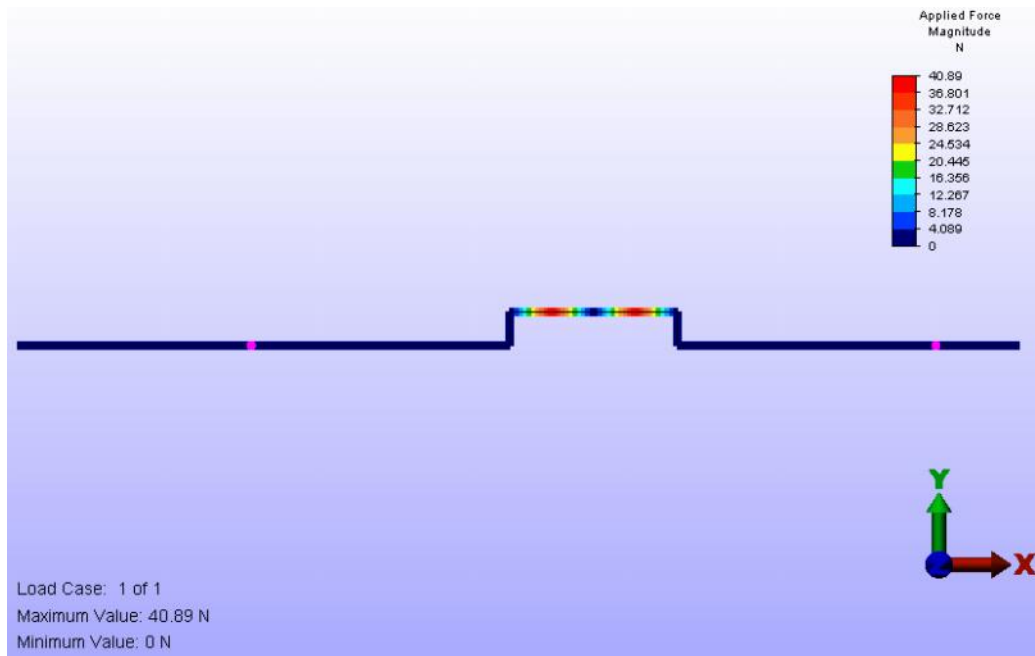
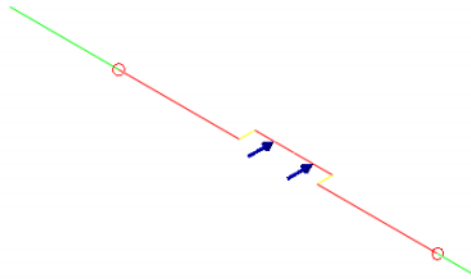


Fig. 3: Magnitud de fuerza aplicado sobre el eje excéntrico del Alimentador Vibratorio.

RESUMEN DE INFORMACIÓN DEL PROCESO DE CÁLCULO EN EL SOFTWARE



Design Analysis



Project created on DateTime no válido..

Last updated on 24/11/2007.

Project checked on 24/11/2007.

Summary

Model Information

Analysis Type - Static Stress with Linear Material Models

Units - Custom - (N, mm, s, deg C, K, V, ohm, A, J)

Model location - D:\IVAN\ALGOR\CURSO 2007\tesis\Eje excentrico\Eje

Analysis Parameters Information

Load Case Multipliers

Static Stress with Linear Material Models may have multiple load cases. This allows a model to be analyzed with multiple loads while solving the equations a single time. The following is a list of load case multipliers that were analyzed with this model.

Load Case	Pressure/Surface Forces	Acceleration/Gravity	Displaced Boundary	Thermal	Voltage
1	0	0	0	0	0

Multiphysics Information

Default Nodal Temperature 0 °C
 Source of Nodal Temperature None
 Time step from Heat Transfer Analysis Last

Processor Information

Type of Solver Sparse
 Disable Calculation and Output of Strains No
 Calculate Reaction Forces No
 Invoke Banded Solver Yes
 Avoid Bandwidth Minimization No
 Stop After Stiffness Calculations No
 Displacement Data in Output File No
 Stress Data in Output File No
 Equation Numbers Data in Output File No
 Element Input Data in Output File No
 Nodal Input Data in Output File No
 Centrifugal Load Data in Output File No

Part Information

Part ID	Part Name	Element Type	Material Name
1	Part 1	Beam	Steel (ASTM-A36)
2	Part 2	Beam	Steel (ASTM-A36)
3	Part 3	Beam	Steel (ASTM-A36)

Element Properties used for:

- Part 1

Element Type	Beam
Section 1 - Area	201.1
Section 1 - SA2	178.2
Section 1 - SA3	178.2
Section 1 - J1	6434
Section 1 - I2	3217
Section 1 - I3	3217
Section 1 - S2	402.1
Section 1 - S3	402.1

Element Properties used for:

- Part 2

Element Type	Beam
Section 1 - Area	254.5
Section 1 - SA2	225.6
Section 1 - SA3	225.6
Section 1 - J1	10310
Section 1 - I2	5153
Section 1 - I3	5153
Section 1 - S2	572.6
Section 1 - S3	572.6

Element Properties used for:

- Part 3

Element Type	Beam
Section 1 - Area	204.8
Section 1 - SA2	174
Section 1 - SA3	174
Section 1 - J1	11320000
Section 1 - I2	17480
Section 1 - I3	699.1
Section 1 - S2	1092

Material Information

Steel (ASTM-A36)

Material Model Standard

Material Source Algor Material Library

Material Source File C:\ARCHIV~1\ALGOR\MatLibs\algormat.mlb

Date Last Updated 1999/06/02-11:03:56

Material Description Structural Steel Mechanics of Materials, 2nd Edition, F.P. Beer and E.R. Johnston, Jr. (mechanical)

Mass Density 0.0000000078548 N*s²/mm/mm³

Modulus of Elasticity 199950 N/mm²

Poisson's Ratio 0.29

Load and Constraint Information

Loads

Load Set 1: Unnamed

Nodal Forces

ID	Description	Node ID	Magnitude	Vx	Vy	Vz	Load Case	Coordinate System ID
1	Unnamed	10	40.89	0	1	0	1	0
2	Unnamed	11	40.89	0	1	0	1	0

Constraints

Constraint Set 1: Unnamed

Nodal Boundary Conditions

ID	Description	Node ID	Tx	Ty	Tz	Rx	Ry	Rz
----	-------------	---------	----	----	----	----	----	----

1	Unnamed	2	No	Yes	Yes	No	No	No
2	Unnamed	8	No	Yes	Yes	No	No	No

Processor Output

Processor Summary

ALGOR (R) Static Stress with Linear Material Models
Version 12.32-WIN 27-JUN-2003
Copyright (c) 1984-2003 ALGOR, Inc. All rights reserved.

DATE: NOVEMBER 24,2007
TIME: 11:23 AM
INPUT MODEL: D:\IVAN\ALGOR\CURSO 2007\tesis\Eje excentrico\Eje
ALG.DLL VERSION:13240000

Structural

1**** CONTROL INFORMATION

number of node points	(NUMNP)	=	17
number of element types	(NELTYP)	=	3
number of load cases	(LL)	=	1
number of frequencies	(NF)	=	0
analysis type code	(NDYN)	=	0
equations per block	(KEQB)	=	0
bandwidth minimization flag	(MINBND)	=	0
gravitational constant	(GRAV)	=	9.8146E+03

**** PRINT OF NODAL DATA SUPPRESSED
**** PRINT OF EQUATION NUMBERS SUPPRESSED
**** PRINT OF TYPE-2 ELEMENT DATA SUPPRESSED
**** PRINT OF TYPE-2 ELEMENT DATA SUPPRESSED
**** PRINT OF TYPE-2 ELEMENT DATA SUPPRESSED
**** Hard disk file size information for processor:

Available hard disk space on current drive = 17687.359
megabytes

1**** NODAL LOADS (STATIC) OR MASSES (DYNAMIC)

NODE	LOAD	X-AXIS	Y-AXIS	Z-AXIS	X-AXIS	Y-AXIS
Z-AXIS	NUMBER	CASE	FORCE	FORCE	FORCE	MOMENT
MOMENT						MOMENT
	10	1	0.000E+00	4.089E+01	0.000E+00	0.000E+00
0.000E+00						0.000E+00
	11	1	0.000E+00	4.089E+01	0.000E+00	0.000E+00
0.000E+00						0.000E+00

1**** ELEMENT LOAD MULTIPLIERS

load case	case A	case B	case C	case D
case E				
1	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**** Invoking Sparse Solver ...

**** Symbolic Assembling Using the Row-Hits Matrix Profile ...

**** Assembled in One Block.

**** Real Sparse Matrix Assembly ...

1**** STIFFNESS MATRIX PARAMETERS

minimum non-zero diagonal element = 2.7350E+03
 maximum diagonal element = 4.3964E+10
 maximum/minimum = 1.6075E+07
 average diagonal element = 2.8851E+09

in the upper off-diagonal matrix:
 number of entries in the profile = 576
 number of symbolic nonzero entries= 459
 number of real nonzero entries = 104

**** Sparse Matrix Assembled in One Block

**** Load case 1

**** Sparse Matrix Factorization ...

Completing in-core sparse solution
 Solver return code 4

warning: your model may not be tied down
 enough or you may have a change in
 stiffness somewhere in your model
 which is too abrupt. Check DOF: 23 -2.328306E-10
 Node number = 5 Tx

warning: your model may not be tied down
 enough or you may have a change in
 stiffness somewhere in your model
 which is too abrupt. Check DOF: 26 -3.143214E-08
 Node number = 5 Rx

**** Sparse Matrix Solving ...

**** End Sparse Matrix Solution

Reaction Sums and Maxima for Load Case 1

Sum of applied forces
 X-Force Y-Force Z-Force X-Moment Y-Moment
 Z-Moment
 0.0000E+00 8.1780E+01 0.0000E+00 0.0000E+00 0.0000E+00
 0.0000E+00

Sum of reactions
 X-Force Y-Force Z-Force X-Moment Y-Moment
 Z-Moment
 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
 4.1655E-10

Sum of residuals

	X-Force	Y-Force	Z-Force	X-Moment	Y-Moment
Z-Moment	0.0000E+00	8.1780E+01	0.0000E+00	0.0000E+00	0.0000E+00
	4.1655E-10				

Sum of unfixed direction residuals

	X-Force	Y-Force	Z-Force	X-Moment	Y-Moment
Z-Moment	0.0000E+00	8.0235E-11	0.0000E+00	0.0000E+00	0.0000E+00
	4.1655E-10				

Largest applied forces and moments

Node	Node	Node	Node	Node	Node
	X-Force	Y-Force	Z-Force	X-Moment	Y-Moment
Z-Moment	0	10	0	0	0
0	0.0000E+00	4.0890E+01	0.0000E+00	0.0000E+00	0.0000E+00
	0.0000E+00				

Largest nodal reactions

Node	Node	Node	Node	Node	Node
	X-Force	Y-Force	Z-Force	X-Moment	Y-Moment
Z-Moment	10	10	0	0	0
6	-7.2760E-12	-4.0890E+01	0.0000E+00	0.0000E+00	0.0000E+00
	1.1369E-10				

Largest nodal residuals

Node	Node	Node	Node	Node	Node
	X-Force	Y-Force	Z-Force	X-Moment	Y-Moment
Z-Moment	10	2	0	0	0
6	-7.2760E-12	4.0890E+01	0.0000E+00	0.0000E+00	0.0000E+00
	1.1369E-10				

Largest unfixed direction residuals

Node	Node	Node	Node	Node	Node
	X-Force	Y-Force	Z-Force	X-Moment	Y-Moment
Z-Moment	10	7	0	0	0
6	-7.2760E-12	5.5024E-11	0.0000E+00	0.0000E+00	0.0000E+00
	1.1369E-10				

1**** TEMPORARY FILE STORAGE (MEGABYTES)

```

-----
UNIT NO. 7 :      0.000
UNIT NO. 8 :      0.001
UNIT NO. 9 :      0.000
UNIT NO. 10 :     0.000
UNIT NO. 11 :     0.001

```

```
UNIT NO. 12 :      0.000
UNIT NO. 13 :      0.000
UNIT NO. 14 :      0.000
UNIT NO. 15 :      0.000
UNIT NO. 17 :      0.000
UNIT NO. 51 :      0.001
UNIT NO. 52 :      0.011
UNIT NO. 54 :      0.000
UNIT NO. 55 :      0.000
UNIT NO. 56 :      0.001
UNIT NO. 58 :      0.000

TOTAL           :      0.016 Megabytes
```

Processor Log

ALGOR (R) Static Stress with Linear Material Models
Version 12.32-WIN 27-JUN-2003
Copyright (c) 1984-2003 ALGOR, Inc. All rights reserved.

Structural

```
17    3    1    0    0    0
**** Linear stress analysis
**** Memory Dynamically Allocated =      261528 KB
```

Options executed are:

```
NOMIN
STRAIN
SPARSE
SUPCNF
SUPELM
SUPNOD
REAC
ENOR
```

processing ...

```
**** OPENING TEMPORARY FILES
NDYN = 0
```

```
DATE: NOVEMBER 24,2007
TIME: 11:23 AM
INPUT MODEL: D:\IVAN\ALGOR\CURSO 2007\tesis\Eje excentrico\Eje
ALG.DLL VERSION:13240000
```

```
**** BEGIN NODAL DATA INPUT
17 NODES
**** END NODAL DATA INPUT
**** BEGIN TYPE-2 DATA INPUT
2 ELEMENTS
**** END TYPE-2 DATA INPUT
**** BEGIN TYPE-2 DATA INPUT
6 ELEMENTS
**** END TYPE-2 DATA INPUT
```

```

**** BEGIN TYPE-2 DATA INPUT
      2 ELEMENTS
**** END   TYPE-2 DATA INPUT
**** Hard disk file size information for processor:

      Available hard disk space on current drive = 17687.359
megabytes

**** BEGIN LOAD INPUT
**** END   LOAD INPUT

**** Invoking Sparse Solver ...

**** Symbolic Assembling Using the Row-Hits Matrix Profile ...
**** Assembled in One Block.
**** Real Sparse Matrix Assembly ...
      in the upper off-diagonal matrix:
      number of entries in the profile = 576
      number of symbolic nonzero entries= 459
      number of real nonzero entries   = 104
**** Sparse Matrix Assembled in One Block
**** Load case 1
**** Sparse Matrix Factorization ...
      Solver return code          4

      warning: your model may not be tied down
      enough or you may have a change in
      stiffness somewhere in your model
      which is too abrupt. Check DOF:      23      -2.328306E-10
      Node number =          5      Tx

      warning: your model may not be tied down
      enough or you may have a change in
      stiffness somewhere in your model
      which is too abrupt. Check DOF:      26      -3.143214E-08
      Node number =          5      Rx
**** Sparse Matrix Solving ...
**** End Sparse Matrix Solution

**** BEGIN DISPLACEMENT OUTPUT
**** PRINT OF DISPLACEMENT OUTPUT SUPPRESSED
**** END   DISPLACEMENT OUTPUT
**** BEGINNING REACTION COMPUTATIONS
**** LOADCASES REMAINING          1
**** BLOCKS REMAINING             1
**** GROUPS REMAINING             3
**** GROUP USED--ELEMENT/GLOBAL CONTRIBUTIONS
      2 ELEMENTS
      2 ELEMENTS REMAINING
**** GROUPS REMAINING             2
**** GROUP USED--ELEMENT/GLOBAL CONTRIBUTIONS
      6 ELEMENTS
      6 ELEMENTS REMAINING
**** GROUPS REMAINING             1
**** GROUP USED--ELEMENT/GLOBAL CONTRIBUTIONS
      2 ELEMENTS
      2 ELEMENTS REMAINING
**** ENDING REACTION COMPUTATIONS

Eje.t7      =          0.492 kilobytes

```

Eje.t8 = 0.840 kilobytes
Eje.t9 = 0.000 kilobytes
Eje.t10 = 0.000 kilobytes
Eje.t11 = 0.812 kilobytes
Eje.t12 = 0.484 kilobytes
Eje.t13 = 0.492 kilobytes
Eje.t14 = 0.000 kilobytes
Eje.t15 = 0.000 kilobytes
Eje.t17 = 0.000 kilobytes
Eje.t51 = 0.781 kilobytes
Eje.t52 = 10.859 kilobytes
Eje.t54 = 0.266 kilobytes
Eje.t55 = 0.406 kilobytes
Eje.t56 = 0.812 kilobytes
Eje.t58 = 0.484 kilobytes

total temporary disk storage (megabytes) = .01634

Eje.l = 6.771 kilobytes
Eje.do = 0.844 kilobytes

**** BEGIN DELETING TEMPORARY FILES
Processing completed for model:
[D:\IVAN\ALGOR\CURSO 2007\tesis\Eje excentrico\Eje]
**** TEMPORARY FILES DELETED
**** END OF SUCCESSFUL EXECUTION

Total actual hard disk space used = 0.024 megabytes

Sub-total elapsed time = 0.011 minutes

ALGOR (R) Stress Calculation Utility
Version 12.16-WIN 25-APR-2003
Copyright (c) 1989-2003 ALGOR, Inc. All rights reserved.

**** Memory Dynamically Allocated = 261528 KB
Percent capacity: .005016

DATE: NOVEMBER 24,2007

TIME: 11:23 AM

INPUT.....D:\IVAN\ALGOR\CURSO 2007\tesis\Eje excentrico\Eje

Percent capacity: .005019

Percent capacity: .005019

**** BEGIN TYPE-2 DATA INPUT

2 ELEMENTS

Percent capacity: .005365

0 elements remaining

**** END TYPE-2 DATA INPUT

**** BEGIN TYPE-2 DATA INPUT

6 ELEMENTS

Percent capacity: .005365

0 elements remaining

**** END TYPE-2 DATA INPUT

**** BEGIN TYPE-2 DATA INPUT

2 ELEMENTS

Percent capacity: .005365

```
          0 elements remaining
**** END   TYPE-2 DATA INPUT
          Percent capacity: .005025
**** Writing stress and strain output files ...
          0 load cases remaining
**** Hard disk file size information for postprocessor:
          Eje.son   =          2.020 kilobytes
          Eje.nso   =          0.859 kilobytes
          Eje.sto   =          0.859 kilobytes

          Total MKNSO disk space used           =          0.00365 megabytes
**** End of successful execution
**** MKNSO elapsed time                         =          0.001 minutes

**** The TOTAL elapsed time                    =          0.012 minutes
```

Stress Analysis

The stress analysis output file (D:\IVAN\ALGOR\CURSO 2007\tesis\Eje excentrico\Eje.S) was not found.

Weight and Center of Gravity Analysis

The weight and center of gravity analysis output file (D:\IVAN\ALGOR\CURSO 2007\tesis\Eje excentrico\Eje.WCG) was not found.