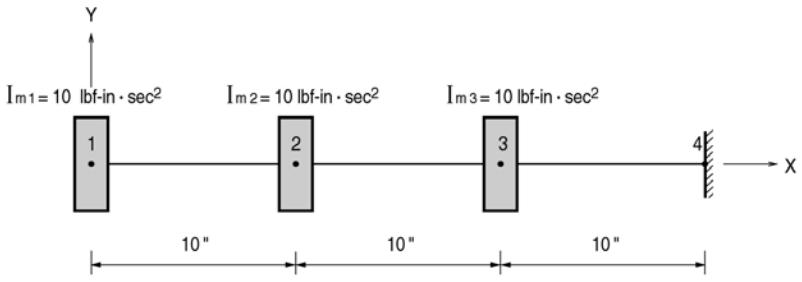
Eigen-3

Title

Eigenvalue analysis of a shaft with three disks

Description

Calculate the eigenvalues of a shaft with three disks.



Structural geometry

MODEL

Analysis Type

3-D eigenvalue analysis

Unit System

in, lbf

Dimension

Length 30.0 in

Rotational mass moment of inertia (Disk) $I_{m1} = I_{m2} = I_{m3} = 10.0$ lbf-in $\cdot$ sec^2

Element

Beam element

Material

Modulus of elasticity $E = 1.04 \times 10^7$ psi

Poisson's ratio $\nu = 0.3$

Section property

Torsional stiffness $I_{xx} = 1.0$ in^4

Boundary Condition

Node 4 ; Constrain all DOFs

Nodes 1 ~ 3 ; Constrain Dx, Dy, Dz, Ry and Rz. (Only Rx allowed)

Analysis Case

Rotational mass moments of inertia exist at the nodes 1, 2 and 3 about the X -axis.

$I_m = 10.0$ lbf-in $\cdot$ sec^2

Number of natural frequencies to be computed = 3

Results

Eigenvalue Analysis Results

EIGENVALUE ANALYSIS												
	Mode No	Frequency (rad/sec)	Frequency (cycle/sec)	Period (sec)	Tolerance							
	1	89,008374	14,166123	0,070591	3,4440e-016							
	2	249,395921	39,692594	0,025194	6,1297e-014							
	3	360,387547	57,357460	0,017435	2,3002e-013							
MODAL PARTICIPATION MASSES(%) PRINTOUT												
	Mode No	TRAN-X		TRAN-Y		TRAN-Z		ROTN-X		ROTN-Y		ROTN-Z	
		MASS	SUM	MASS	SUM	MASS	SUM	MASS	SUM	MASS	SUM	MASS	SUM
	1	0,00	0,00	0,00	0,00	0,00	0,00	91,41	91,41	0,00	0,00	0,00	0,00
	2	0,00	0,00	0,00	0,00	0,00	0,00	7,49	98,90	0,00	0,00	0,00	0,00
	3	0,00	0,00	0,00	0,00	0,00	0,00	1,10	100,00	0,00	0,00	0,00	0,00
EIGENVECTOR													

Comparison of Results

Unit : rad/sec

Angular velocity	Theoretical	MSC/NASTRAN	NISA II	MIDAS/Civil
ω_1	89.000	89.008	89.008	89.008
ω_2	249.400	249.396	249.400	249.396
ω_3	360.400	360.388	360.390	360.388

References

Walter C. Hurty and Moshe F. Rubinstein, "*Dynamics of Structures*", Englewood Cliffs, Prentice-Hall, Inc., 1964.

"*MSC/NASTRAN, Verification Problem Manual*", V.64, The MacNeal-Schwendler Corporation, 1986, Problem No. V0303.

"*NISA II, Verification Manual*", Version 91.0, Engineering Mechanics Research Corporation, 1991.