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Hand-out
Advanced vibration
Longitudinal vibration of bar fixed at one end
and mass-spring at the other end

```
clc;clear all;format long
ro=7500; E=200e9;A=4.5e-5;L=3.5; % Density, Young's Module, Area and Length
k=9e5;m0=2.5; % Define ended mass and spring
k0=e*a/l; m=ro*a*l;c=sqrt(e/ro);
b=(c/l)^2;
f = @(x) tan(x)/x-k0/(b*(m0*x^2-k/b));
options = optimset('Display','iter');
alpha-n = fzero(f,1,options)
omega= alpha-n*c/(2*pi*1)
```

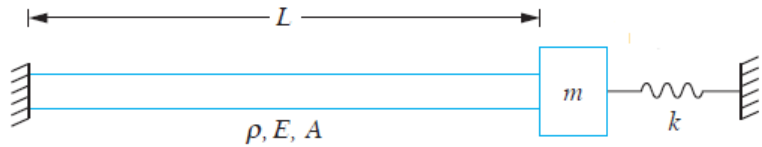
! ANSYS CODE

```
/PREP7
SMRT,OFF
MP,EX,1,200E9
MP,DENS,1,7.5E3
ET,1,LINK180
SECT,1,LINK
SECD,4.5E-5
K,1
K,2,3.500
L,1,2
ESIZE,,100
LMESH,1
ET,2,MASS21,,,4
R,2,2.5
TYPE,2
REAL,2
E,2
ET,3,COMBIN14,,1
R,3,9e5
TYPE,3
REAL,3
N,102,4
E,2,102
NSEL,ALL
D,ALL,UY
D,ALL,UZ
D,1,UX
D,102,UX
FINISH
/SOL
!*
ANTYPE,2
MODOPT,LANB,20
EQLSV,SPAR
MXPAND,20,,0
LUMPM,0
SOLVE
FINISH
```

MATLAB RESULTS	
α_n	
0.740407428999668	
3.286570519757705	
6.357672218054080	
9.474698154440917	
12.603880533823610	
15.737997173291673	
18.874595961548764	
22.012617566387902	
25.151530063280227	
28.291037182812143	

ANSYS RESULTS (Hz)	
1	173.86
2	771.79
3	1493.2
4	2225.7
5	2961.6
6	3699.4
7	4438.7
8	5179.4
9	5921.7
10	6665.5

MATLAB RESULTS (Hz)	
1	173.863
2	771.755
3	1492.913
4	2224.855
5	2959.652
6	3695.608
7	4432.147
8	5169.019
9	5906.101
10	6643.322



$\rho = 7500 \text{ kg/m}^3$
 $E = 200 \times 10^9 \text{ N/m}^2$
 $A = 4.5 \times 10^{-5} \text{ m}^2$
 $k = 9 \times 10^5 \text{ N/m}$
 $m = 2.5 \text{ kg}$
 $L = 3.5 \text{ m}$