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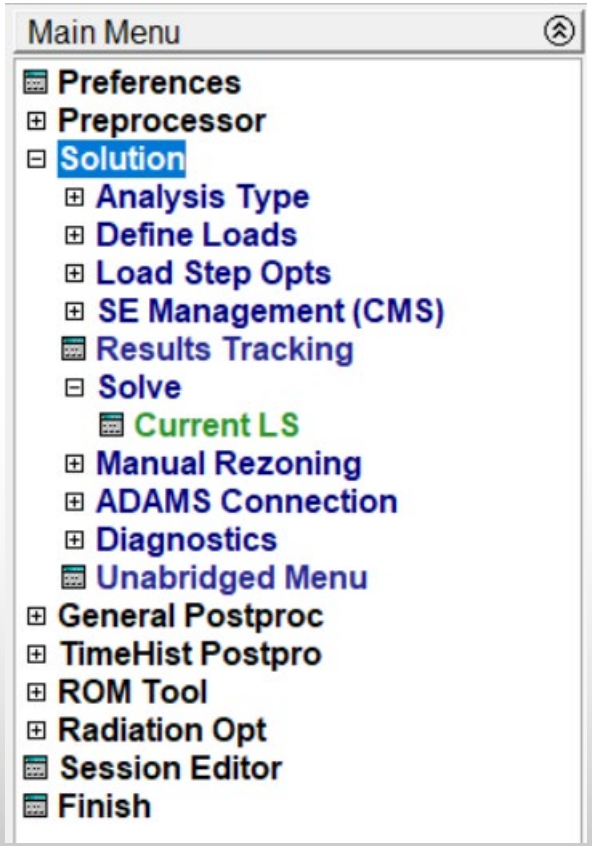
How to use ANSYS APDL to obtain a Momentum TMD with excellent performance

The described methodology can also be used to evaluate other types of modifications to the system, i.e. supports, brazing, snubbers/dampers, mass addition etc.

Necessary steps

1. Set up and run a ANSYS APDL modal analysis.
2. Save results to two text-files and send data to Momentum for virtual simulations with Momentum TMDs
3. Receive results for pipe system with Momentum TMDs installed

Start analysis



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A progress window with the total number of modes is shown when running modal analysis

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Copy getmodes.txt to ANSYS analysis file folder and run from APDL command prompt


```
!Script for saving eigenfrequencies and eigenmodes to files from ANSYS APDL
!"freqvec.txt" and "modes.txt" should be sent to Momentum for further processing and vibration damper recommendation
!Please contact Even.Lund@momentumtechnologies.com for help

!run this script in Ansys APDL with "/input,getmodes,inp"

MODES=30 !change to the number of modes of interest, recommended to include eigenfrequencies up to 2xfrequency of interest

/post1 !start post processor

!save eigenfrequencies to freqvec.txt
/output,freqvec,txt
set,list
/output,term

!save eigenvectors to modes.txt
nsel,s,node,,all !output results for all nodes
/output,modes,txt
*do,i,1,MODES !output the 30 first modes
  set,,i
  prdisp
*enddo
/output,term
```

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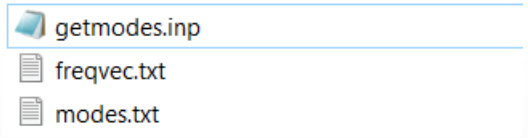
Results are saved to freqvec.txt and modes.txt




```
*****  INDEX OF DATA SETS ON RESULTS FILE  *****

 SET    TIME/FREQ     LOAD STEP   SUBSTEP  CUMULATIVE
   1  0.0000              1          1          1
   2  0.0000              1          2          2
   3  0.0000              1          3          3
   4 0.13283E-03          1
   5 0.14891E-03          1
   6 0.23014E-03          1
   7  2.2731              1
   8  3.1321              1
   9  4.6225              1
  10  8.7076              1
  11  11.224              1
  12  14.343              1
  13  17.642              1
  14  20.465              1
  15  23.439              1
  16  24.599              1
  17  28.143              1
  18  29.310              1
  19  31.028              1
  20  56.856              1
  21  64.646              1
  22  67.382              1
  23  72.066              1
  24  84.424              1
  25  91.655              1
  26  93.810              1
```

```
 LOAD STEP=     1  SUBSTEP=    13
  FREQ=    17.642      LOAD CASE=   0

 THE FOLLOWING DEGREE OF FREEDOM RESULTS ARE IN THE GLOBAL COORDINATE SYSTEM

   NODE       UX           UY           UZ           ROTX         ROTY         ROTZ
      1 -0.64533E-001 0.11411E-001-0.25683E-002-0.99719E-002-0.46337E-001 0.66462E-001
      2 -0.54157E-001 0.91784E-002-0.25683E-002-0.99634E-002-0.46289E-001 0.66457E-001
      3 -0.61940E-001 0.10853E-001-0.25683E-002-0.99718E-002-0.46336E-001 0.66461E-001
      4 -0.59346E-001 0.10295E-001-0.25683E-002-0.99708E-002-0.46331E-001 0.66461E-001
      5 -0.56751E-001 0.97366E-002-0.25683E-002-0.99682E-002-0.46317E-001 0.66459E-001
      6 -0.47246E-001 0.76911E-002-0.25681E-002-0.99344E-002-0.46123E-001 0.66448E-001
      7 -0.51851E-001 0.86823E-002-0.25682E-002-0.99567E-002-0.46251E-001 0.66454E-001
      8 -0.49548E-001 0.81865E-002-0.25682E-002-0.99471E-002-0.46196E-001 0.66452E-001
      9 -0.23628E-001 0.32590E-002-0.21122E-002-0.97044E-002-0.44823E-001 0.66323E-001
     10 -0.44235E-001 0.70617E-002-0.25549E-002-0.99142E-002-0.46006E-001 0.66445E-001
     11 -0.40767E-001 0.63718E-002-0.25151E-002-0.98879E-002-0.45855E-001 0.66442E-001
     12 -0.36901E-001 0.56332E-002-0.24494E-002-0.98545E-002-0.45664E-001 0.66434E-001
     13 -0.32705E-001 0.48591E-002-0.23591E-002-0.98132E-002-0.45430E-001 0.66416E-001
     14 -0.28255E-001 0.40630E-002-0.22460E-002-0.97633E-002-0.45150E-001 0.66382E-001
     15  0.34067E-002-0.99297E-003-0.10387E-002-0.91623E-002-0.41979E-001 0.65040E-001
     16 -0.18904E-001 0.24606E-002-0.19605E-002-0.96362E-002-0.44450E-001 0.66234E-001
     17 -0.14162E-001 0.16813E-002-0.17935E-002-0.95585E-002-0.44030E-001 0.66104E-001
     18 -0.94823E-002 0.93425E-003-0.16143E-002-0.94717E-002-0.43568E-001 0.65928E-001
     19 -0.49447E-002 0.23214E-003-0.14264E-002-0.93762E-002-0.43068E-001 0.65696E-001
     20 -0.62539E-003-0.41352E-003-0.12333E-002-0.92727E-002-0.42536E-001 0.65402E-001
     21  0.27410E-001-0.43666E-002 0.14774E-003-0.83660E-002-0.38382E-001 0.61427E-001
     22  0.74966E-002-0.15678E-002-0.83381E-003-0.90399E-002-0.41380E-001 0.64587E-001
     23  0.11556E-001-0.21383E-002-0.63143E-003-0.89135E-002-0.40780E-001 0.64073E-001
     24  0.15581E-001-0.27040E-002-0.43182E-003-0.87829E-002-0.40180E-001 0.63498E-001
     25  0.19567E-001-0.32643E-002-0.23524E-003-0.86481E-002-0.39581E-001 0.62864E-001
     26  0.23511E-001-0.38187E-002-0.41964E-004-0.85092E-002-0.38981E-001 0.62173E-001
     27  0.41523E-001-0.59858E-002 0.10450E-002-0.74627E-002-0.34847E-001 0.55826E-001
     28  0.30882E-001-0.48433E-002 0.32254E-003-0.82253E-002-0.37805E-001 0.60666E-001
```

Send files

- Send files (freqvec.txt + modeshapes.txt) to Momentum with optional description of node with maximum vibration and frequency. 2% damping will be used if inherent material or modal damping is not provided.

Complex problems, simple solutions

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