



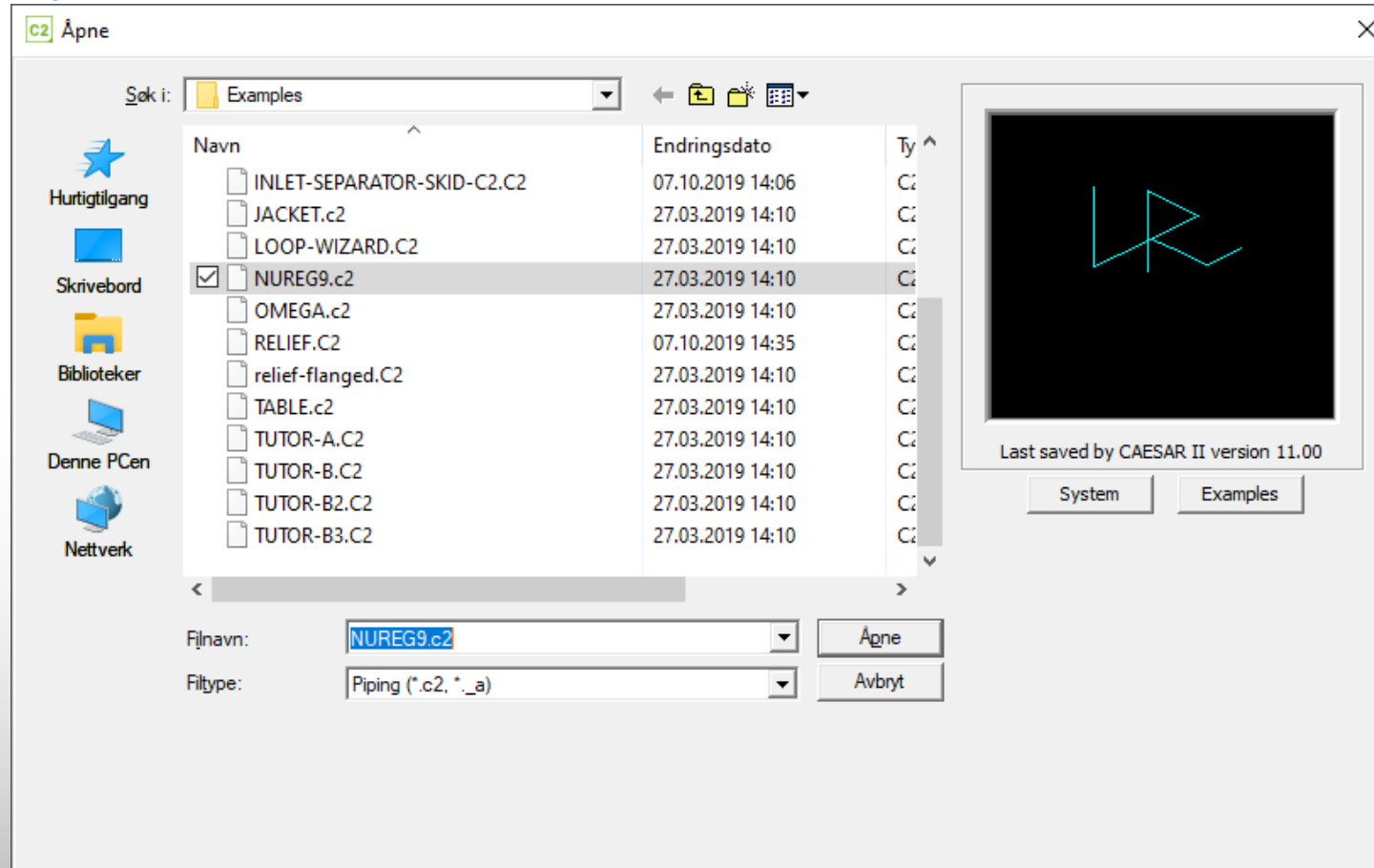
How to use Caesar II to obtain a Momentum TMD with excellent performance

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

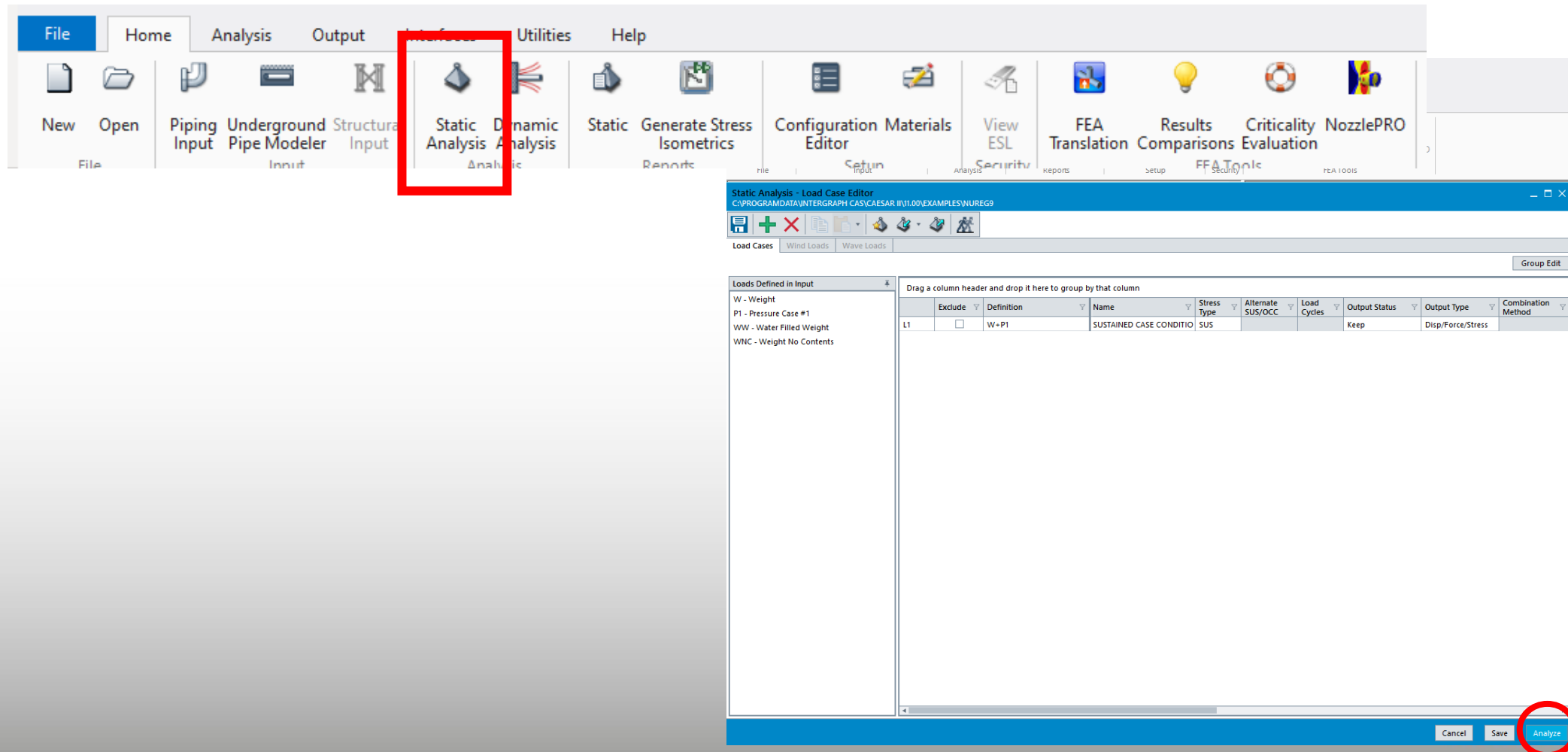
Necessary steps

1. Set up a Caesar II analysis.
2. Optional – Run static analysis
3. Run dynamic analysis, modal analysis, with given setup
4. Save results to two text-files and send data to Momentum for virtual damping with Momentum TMDs
5. Receive results for pipe system with Momentum TMDs installed
6. Request quotation, order dampers, production, delivery and verification of function.

Set up the CAESAR II analysis as usually done for static analysis. I am using the «Nureg9.c2» from the examples

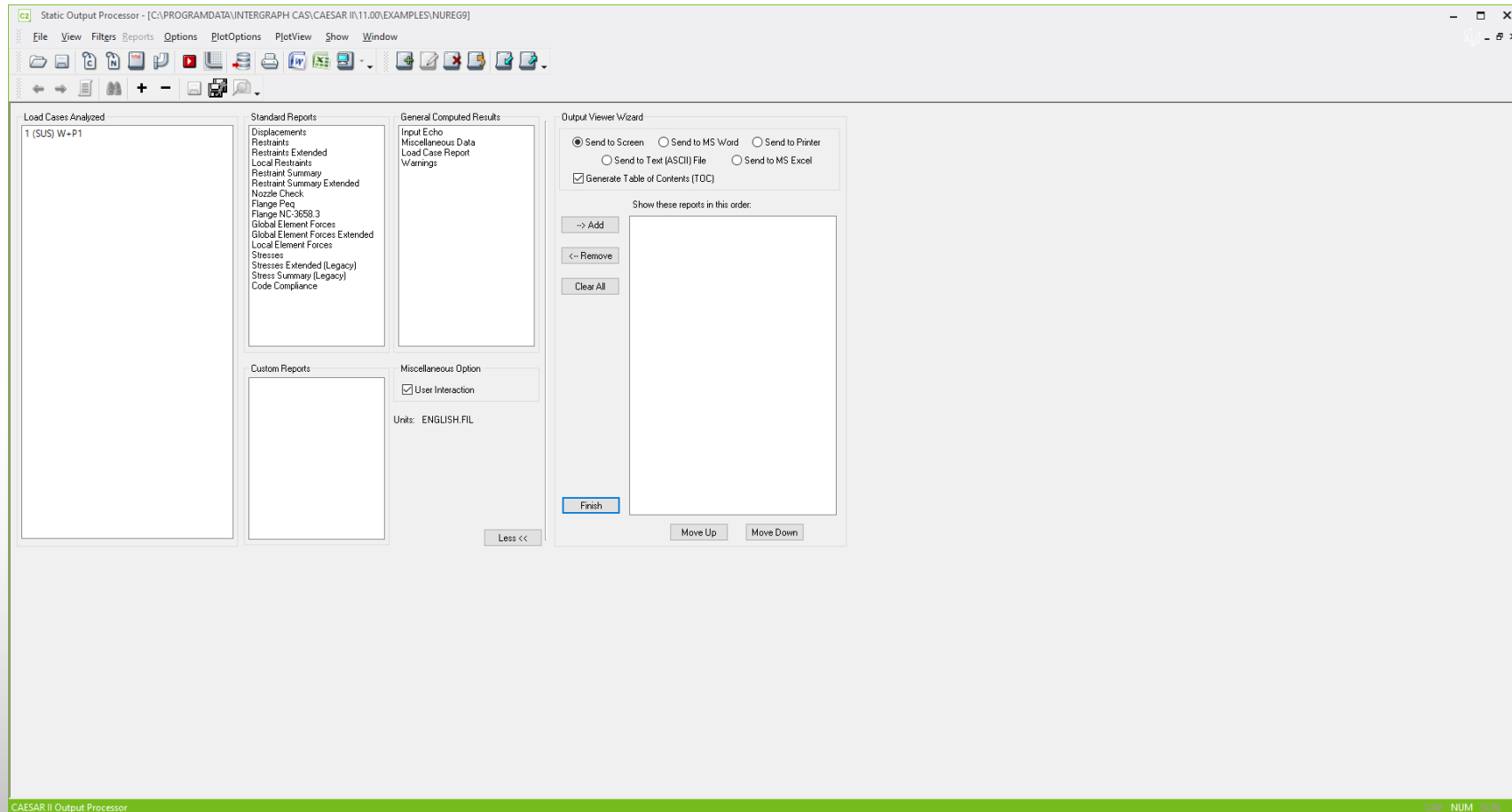


Optional – Run the static analysis first, so that static deflections and contacts are properly set up

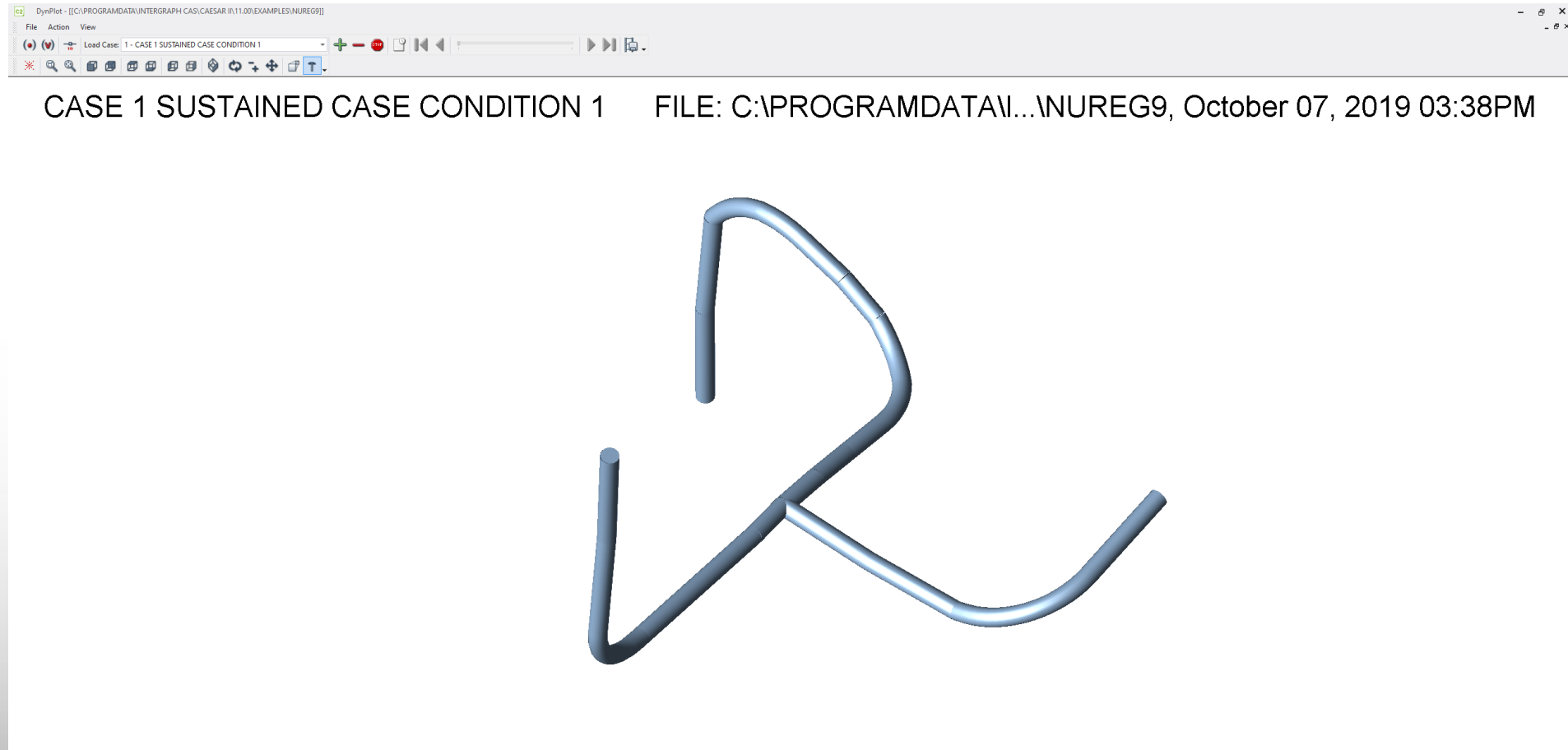


Evaluate static results as necessary

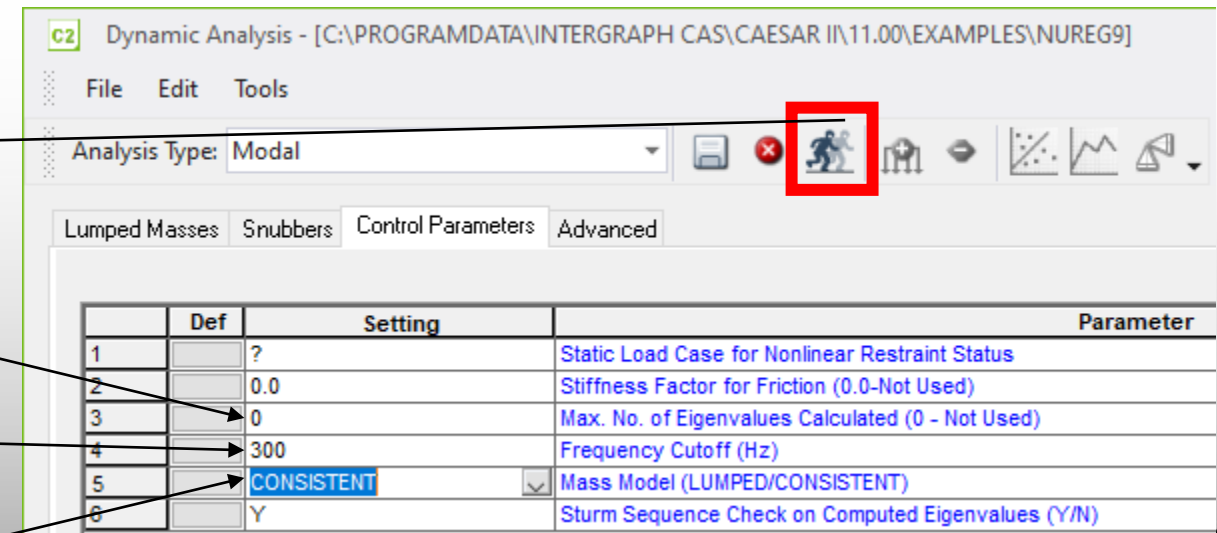
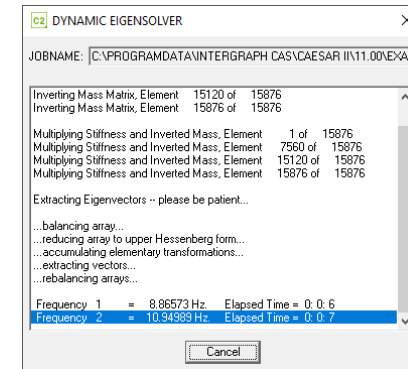
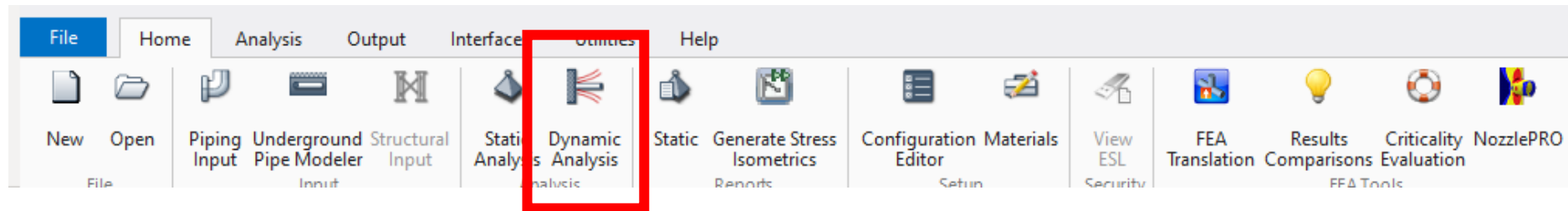
Close results when ready for dynamic analysis



Optional - Show animation of displacement



Start the dynamic analysis and open «Modal» Analysis type. Change settings to the ones shown and press run

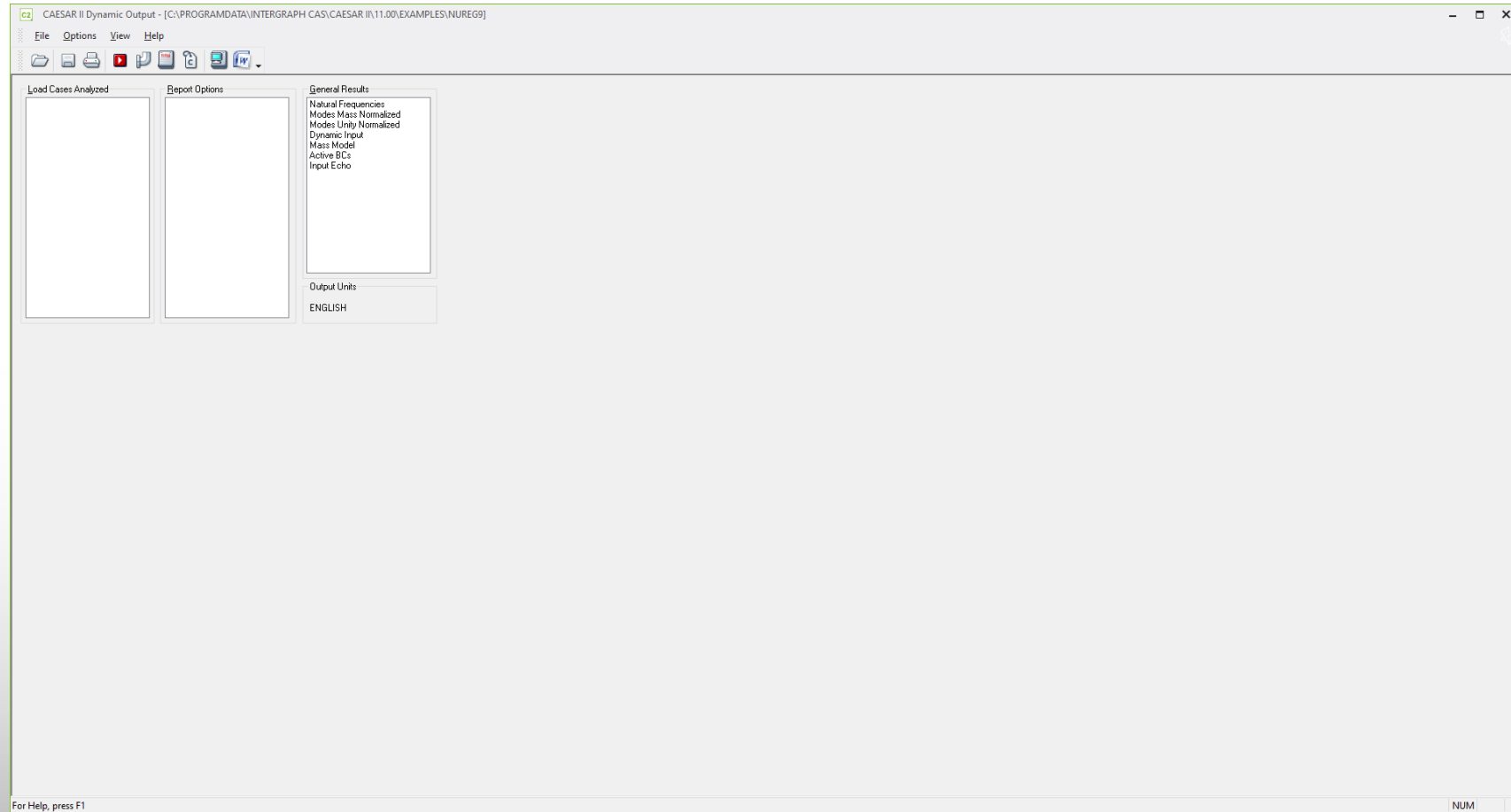


Set this to «0» to let the frequency cutoff be the limitation

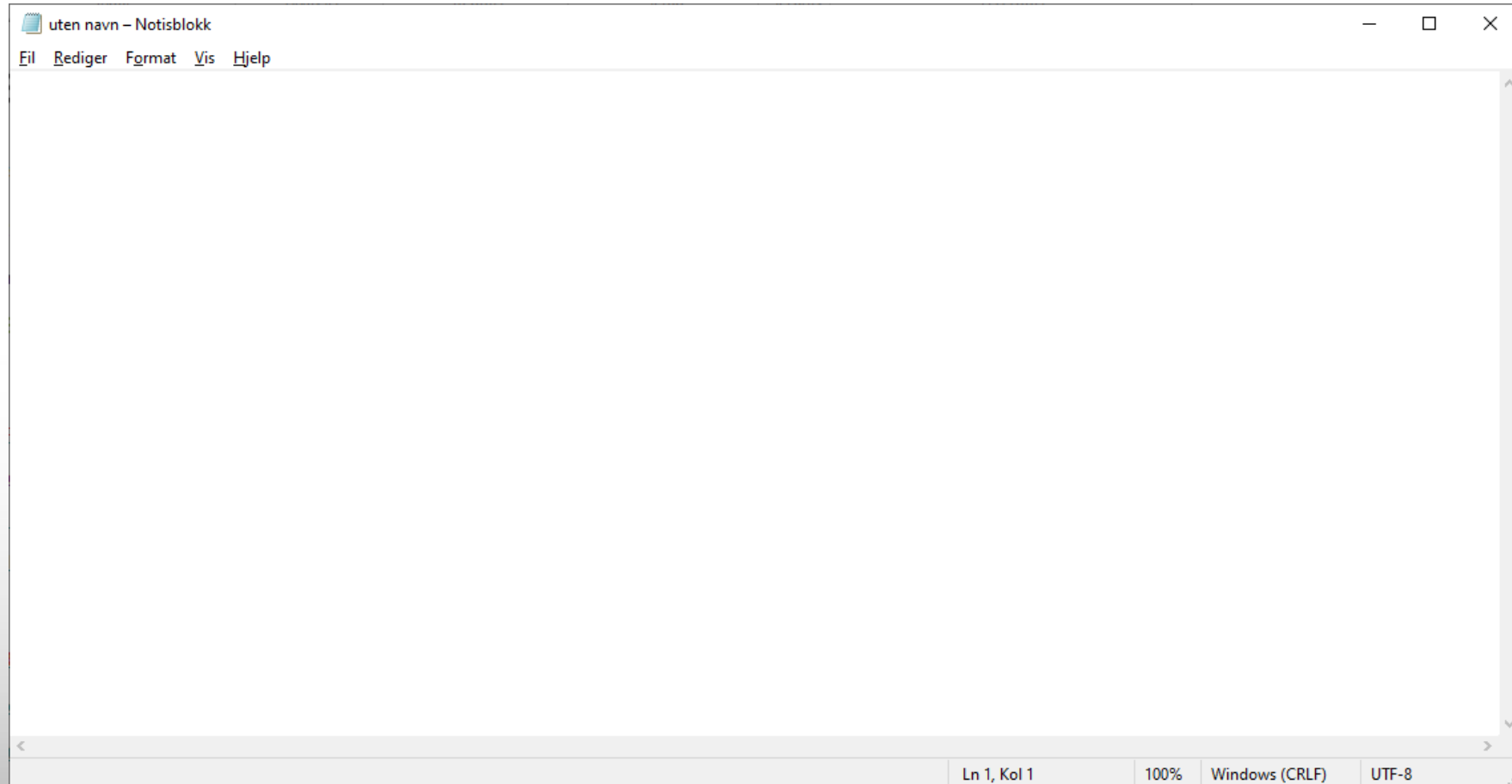
Set cutoff frequency to «300» Hz

Set mass model to «Consistent»

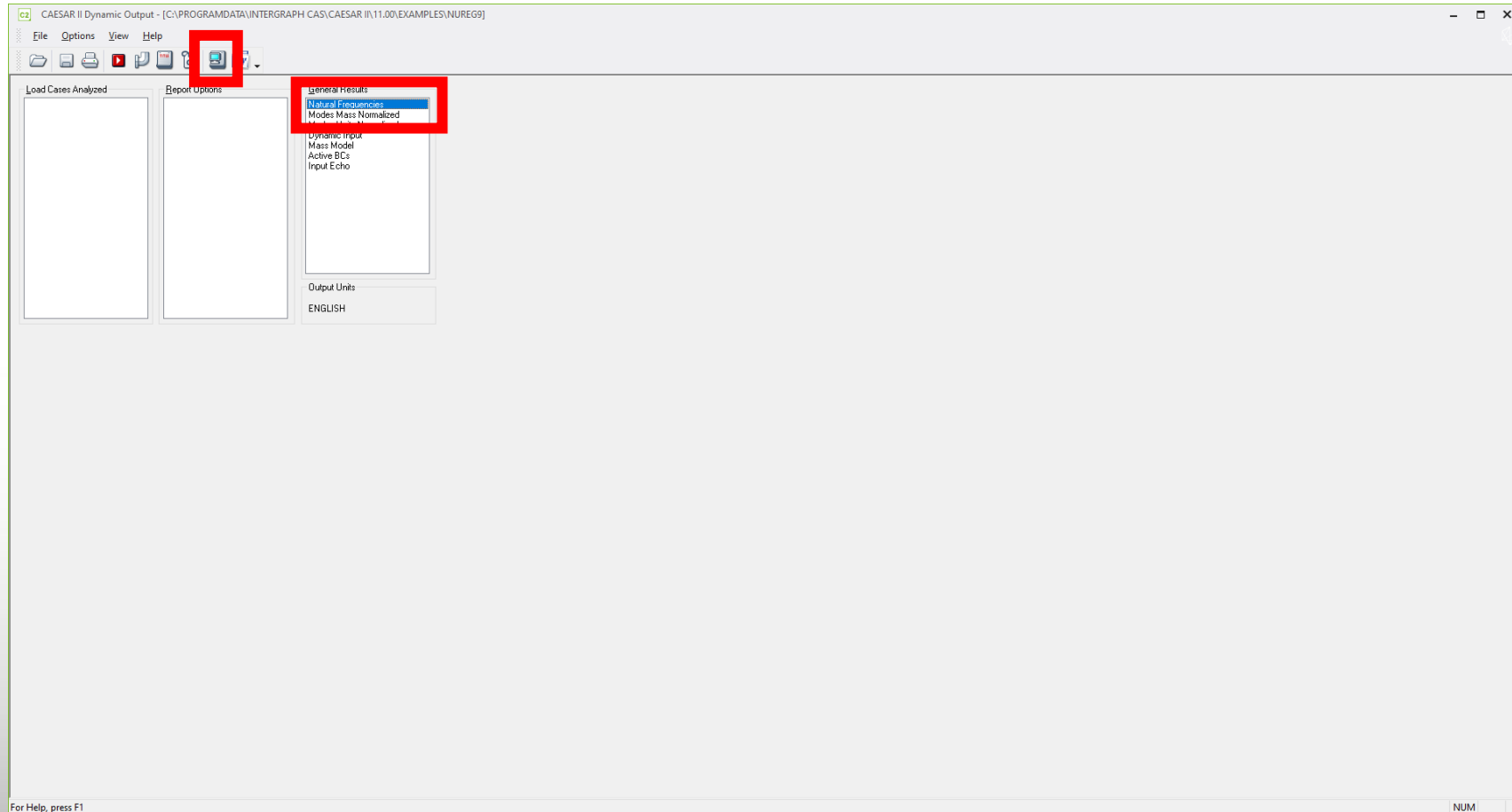
The results from the modal analysis is displayed



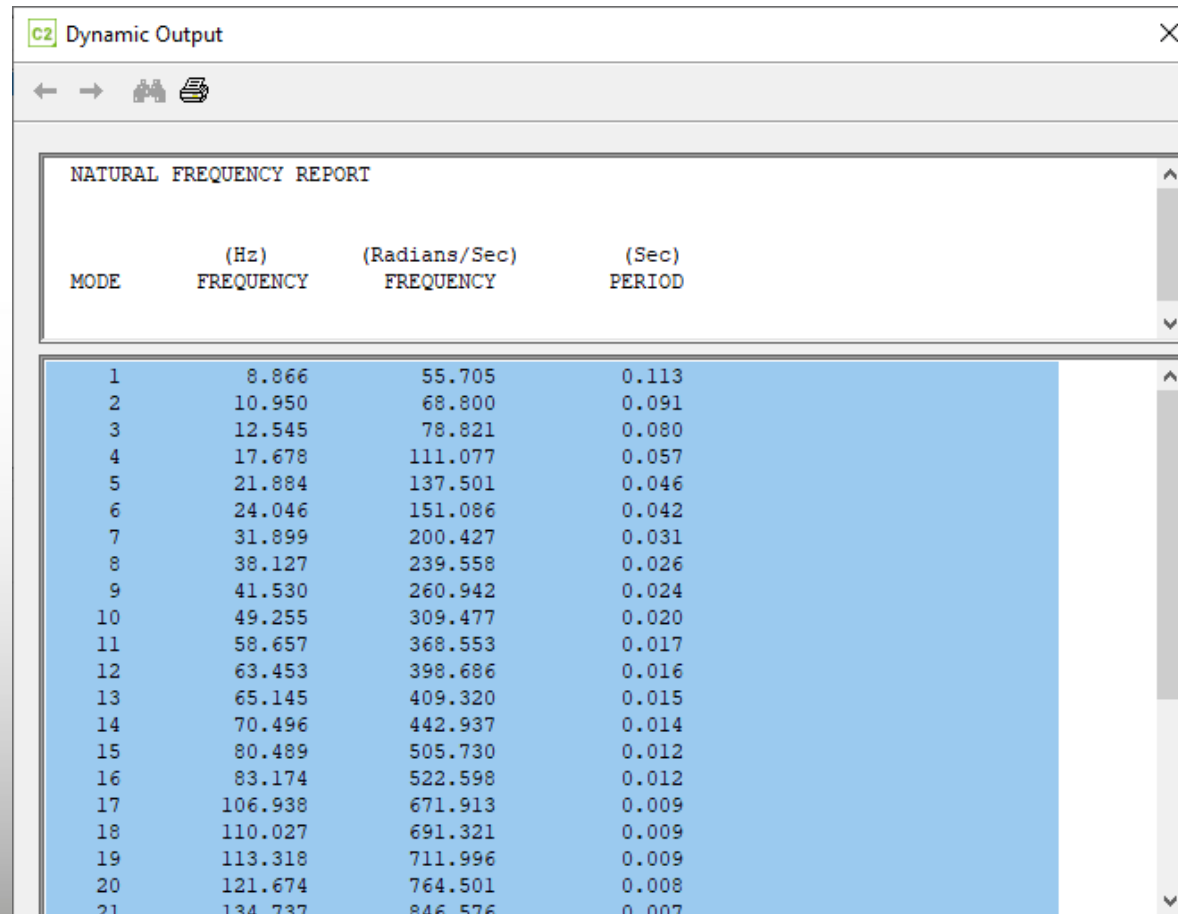
Open windows «notepad» or a different textfile editing software



Select «Natural Frequencies» and «View reports»



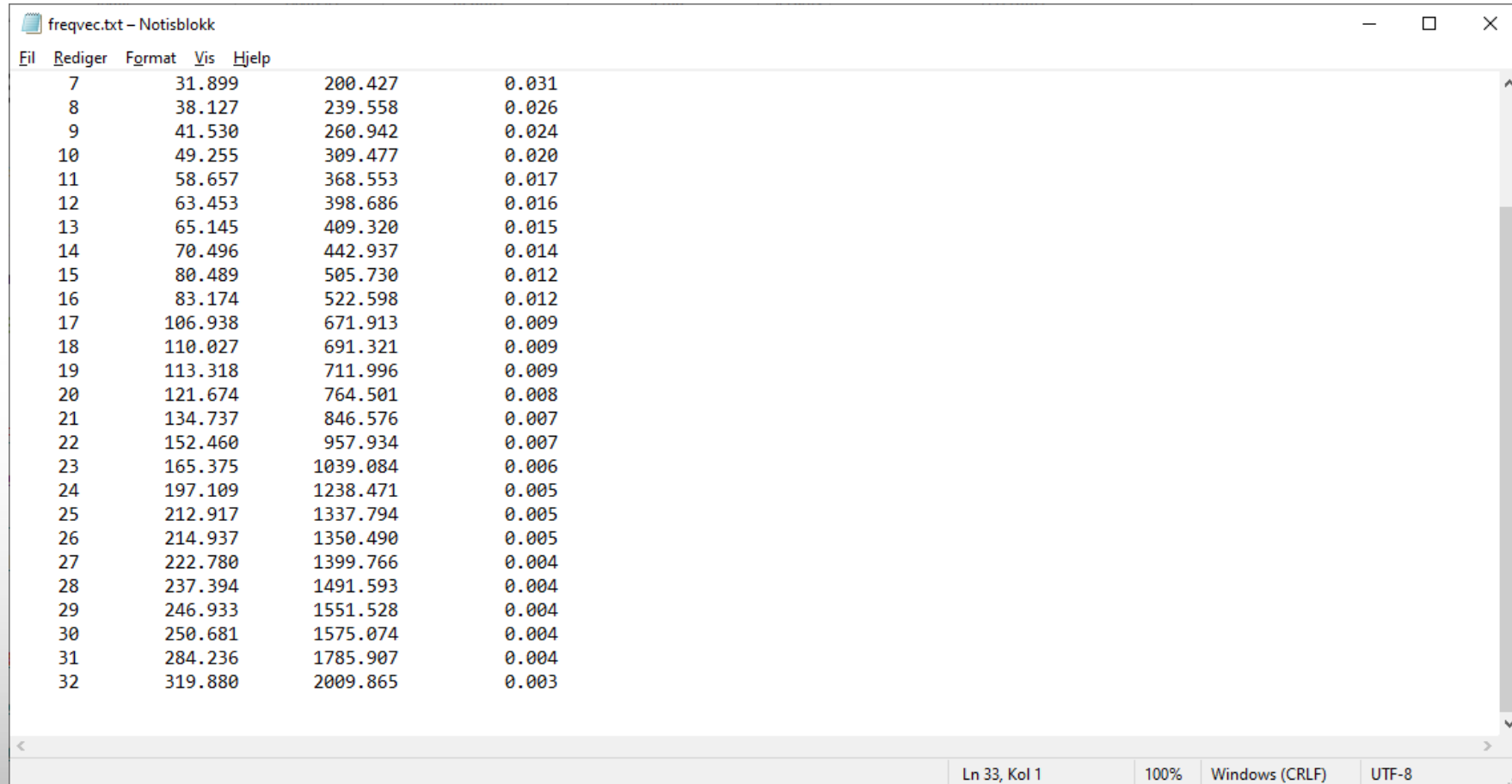
The different modes are shown with respective natural frequencies and period. Click in the lower section. Press ctrl+a and Ctrl+C to select everything and copy the data to the clipboard



The screenshot shows a window titled "c2 Dynamic Output" with a "NATURAL FREQUENCY REPORT" table. The table has four columns: "MODE", "(Hz) FREQUENCY", "(Radians/Sec) FREQUENCY", and "(Sec) PERIOD". The data is as follows:

MODE	(Hz) FREQUENCY	(Radians/Sec) FREQUENCY	(Sec) PERIOD
1	8.866	55.705	0.113
2	10.950	68.800	0.091
3	12.545	78.821	0.080
4	17.678	111.077	0.057
5	21.884	137.501	0.046
6	24.046	151.086	0.042
7	31.899	200.427	0.031
8	38.127	239.558	0.026
9	41.530	260.942	0.024
10	49.255	309.477	0.020
11	58.657	368.553	0.017
12	63.453	398.686	0.016
13	65.145	409.320	0.015
14	70.496	442.937	0.014
15	80.489	505.730	0.012
16	83.174	522.598	0.012
17	106.938	671.913	0.009
18	110.027	691.321	0.009
19	113.318	711.996	0.009
20	121.674	764.501	0.008
21	134.737	846.576	0.007

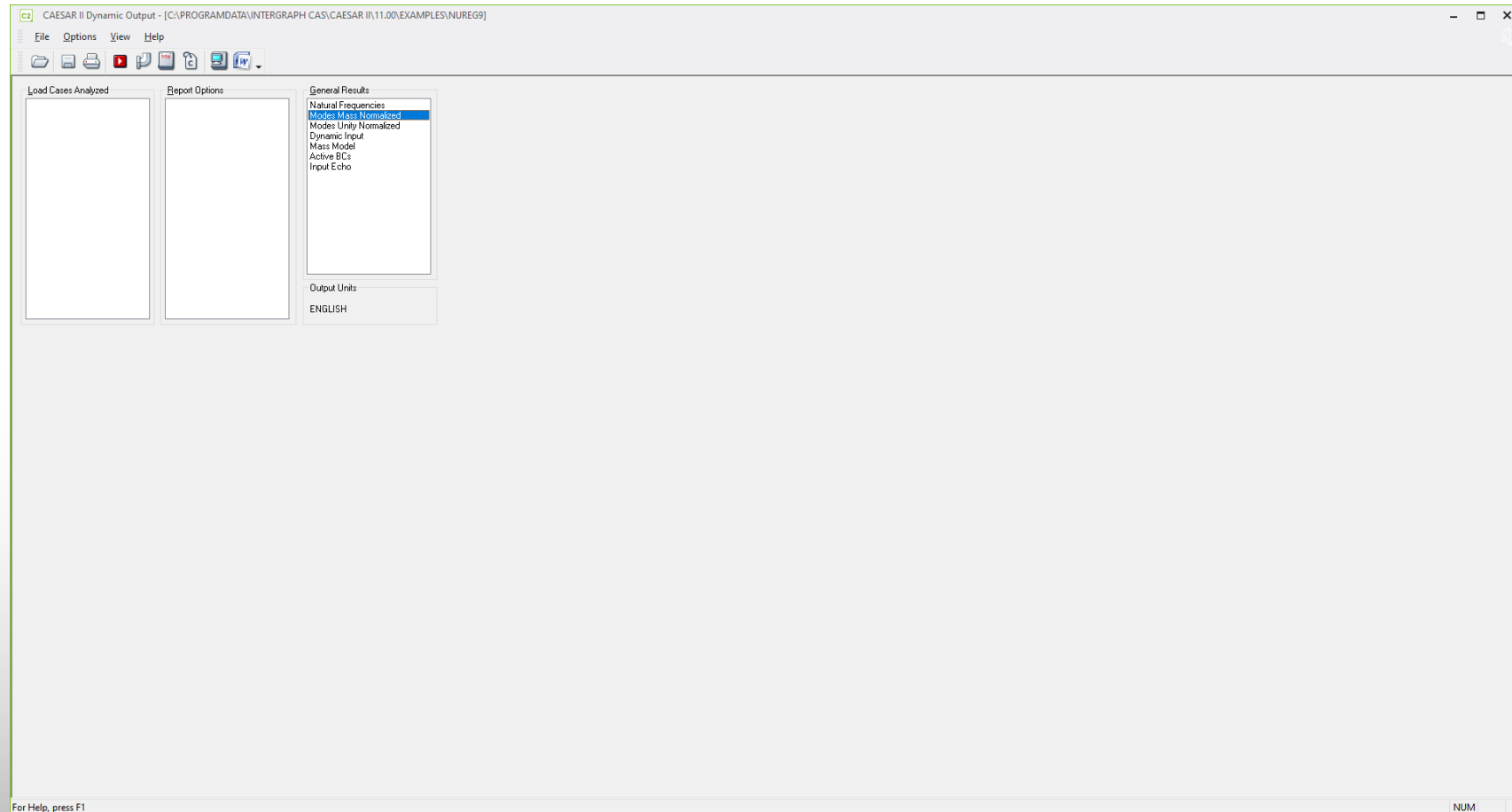
Paste the data into the notepad with ctrl+v or select paste from the menu. Save the file as «freqvec.txt» in a folder.



The screenshot shows a Notepad window titled "freqvec.txt - Notisblokk". The window contains a table with 4 columns and 26 rows of data. The columns represent sequential values from 7 to 32, and the other three columns contain numerical data. The status bar at the bottom indicates "Ln 33, Kol 1", "100%", "Windows (CRLF)", and "UTF-8".

7	31.899	200.427	0.031
8	38.127	239.558	0.026
9	41.530	260.942	0.024
10	49.255	309.477	0.020
11	58.657	368.553	0.017
12	63.453	398.686	0.016
13	65.145	409.320	0.015
14	70.496	442.937	0.014
15	80.489	505.730	0.012
16	83.174	522.598	0.012
17	106.938	671.913	0.009
18	110.027	691.321	0.009
19	113.318	711.996	0.009
20	121.674	764.501	0.008
21	134.737	846.576	0.007
22	152.460	957.934	0.007
23	165.375	1039.084	0.006
24	197.109	1238.471	0.005
25	212.917	1337.794	0.005
26	214.937	1350.490	0.005
27	222.780	1399.766	0.004
28	237.394	1491.593	0.004
29	246.933	1551.528	0.004
30	250.681	1575.074	0.004
31	284.236	1785.907	0.004
32	319.880	2009.865	0.003

Open a new file in the notepad by pressing file-new or shortcut key ctrl+n. Close the Output window for natural frequencies in Caesar. Press «Modes Mass Normalized» and press «View reports» again



Repeat clicking in the lower window, pressing ctrl+a and ctrl-c. Paste in notepad with ctrl+v and save to «modeshapes.txt»

Dynamic Output

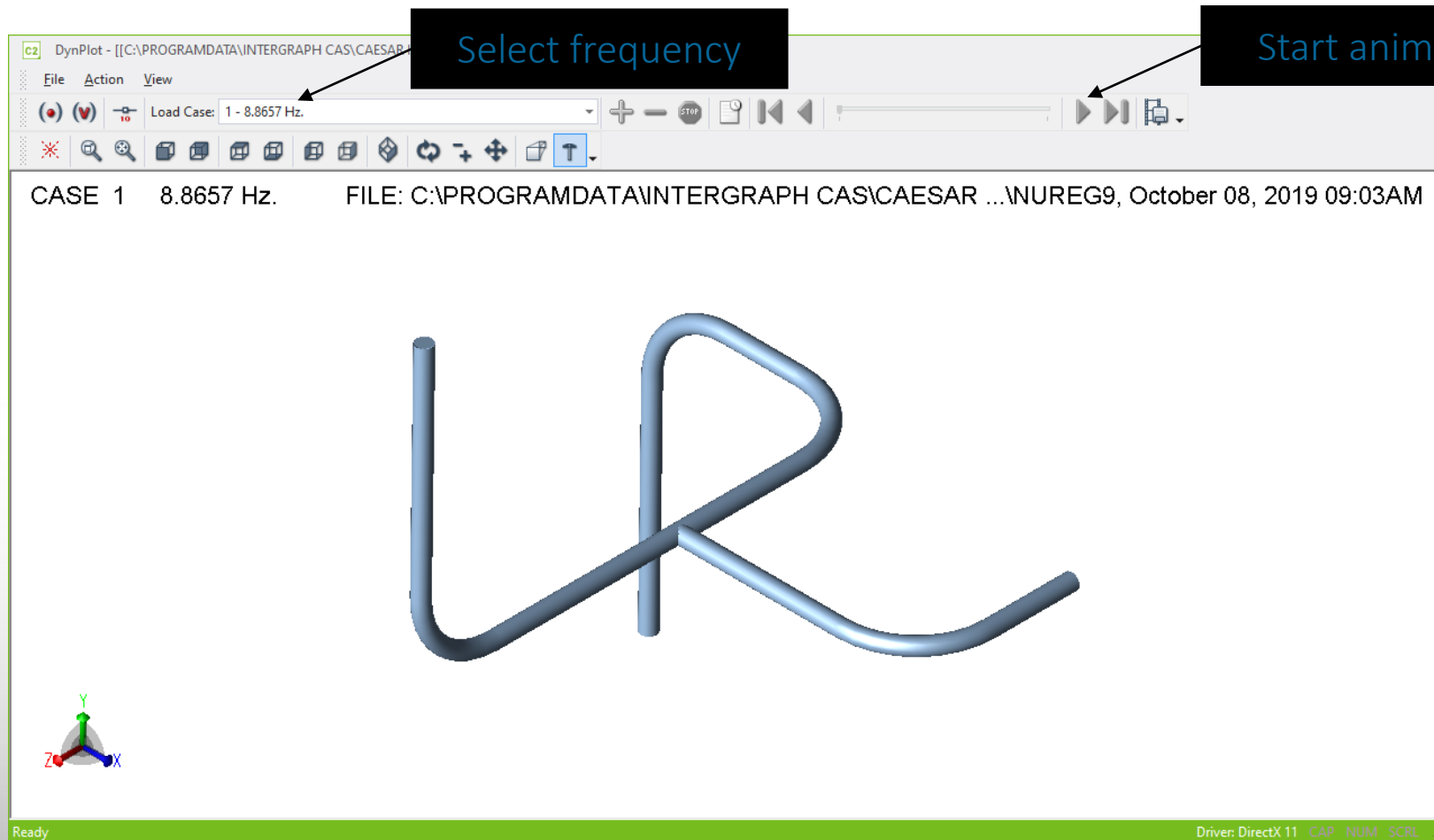
MODE SHAPE REPORT, Mass Normalized

NODE	-----Translations-----			-----Rotations-----		
	DX	DY	DZ	RX	RY	RZ
MODE 1 Frequency (Hz) = 8.866						
1	-0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	-0.0606	0.0001	0.1501	0.0049	0.0027	0.0020
3	-0.1940	0.0002	0.4722	0.0064	0.0055	0.0027
4	-0.2649	0.0295	0.5627	0.0057	0.0072	0.0027
5	-0.2924	0.0938	0.3964	0.0047	0.0101	0.0023
6	-0.2924	0.1324	0.2069	0.0043	0.0111	0.0020
7	-0.2924	0.1668	-0.0000	0.0039	0.0121	0.0018
8	-0.1647	0.1665	-0.3168	0.0032	0.0106	0.0011
9	-0.0000	0.1042	-0.4036	0.0023	0.0019	0.0006
10	0.0051	0.0611	-0.4043	0.0019	-0.0010	0.0002
11	-0.0380	0.0275	-0.4050	0.0014	-0.0028	-0.0002
12	-0.1062	0.0046	-0.4056	0.0009	-0.0035	-0.0006
13	-0.1865	-0.0092	-0.4059	0.0005	-0.0042	-0.0011
14	-0.5280	-0.0116	-0.4068	-0.0003	-0.0050	-0.0028
15	-0.5628	-0.0007	-0.4015	0.0016	-0.0045	-0.0044
16	-0.3005	-0.0004	-0.2468	0.0039	-0.0045	-0.0053
17	-0.0000	-0.0000	-0.0000	0.0049	-0.0045	-0.0057
18	-0.1066	-0.0139	-0.2782	0.0008	-0.0035	-0.0003
19	-0.1068	-0.0234	-0.1216	0.0006	-0.0041	-0.0001

modeshapes.txt - Notisblokk

MODE	32	Frequency (Hz) =	319.880			
21	-0.0000	0.0000	-0.0000	0.0000	-0.0000	-0.0000
1	-0.0000	0.0000	-0.0000	-0.0000	0.0000	0.0000
2	-0.0186	0.0030	-0.0933	0.0042	-0.4183	-0.0036
3	0.0115	0.0046	-0.1029	-0.0350	-0.3698	0.0104
4	-0.2064	0.0482	0.1974	-0.1628	-0.1720	-0.0104
5	-0.0059	-0.2570	-0.1773	-0.2215	-0.0142	0.0135
6	0.0077	0.1287	-0.0407	-0.2111	-0.0051	0.0163
7	0.0208	0.2359	0.0001	-0.1704	-0.0003	-0.0128
8	0.1036	-0.1061	-0.1265	-0.0829	0.0007	-0.0828
9	-0.0001	0.0923	-0.0552	-0.0052	-0.0011	-0.0884
10	-0.0030	-0.0315	-0.0358	0.0097	0.0004	-0.0769
11	0.0071	-0.1935	-0.0137	-0.0003	-0.0000	-0.0509
12	-0.0056	-0.0580	0.0093	-0.0067	-0.0015	-0.0154
13	-0.0671	0.0082	0.0332	-0.0034	-0.0007	-0.0248
14	0.0001	-0.0022	0.0890	-0.0003	-0.0050	-0.0224
15	-0.0036	0.0075	-0.0075	-0.0029	-0.0064	-0.0029
16	-0.0018	0.0049	0.0053	-0.0006	0.0048	-0.0010
17	0.0000	0.0000	0.0000	-0.0011	0.0106	-0.0005
18	0.0025	0.0229	-0.0027	-0.0085	-0.0004	-0.0037
19	0.0054	-0.0224	0.0028	-0.0047	-0.0004	-0.0033
20	-0.0003	0.0057	0.0002	0.0003	0.0001	0.0019
21	-0.0000	0.0000	0.0000	-0.0000	-0.0000	0.0000

Optional: Animate mode shapes. Open mode shapes with natural frequencies close to problem frequency and check whether mode shape is plausible



Select frequency

Start animation

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.

Receive description of vibration reduction with Momentum TMD

Order Momentum TMD

Complex problems,
simple solutions

