This report consists of two parts: user manual for Nonlinear Equation Solver and solved cases by using solver. *(All units are in metric system)*

User Manual

This Nonlinear Equation Solver was written for term project of ME579-Nonlinear Vibrations by using DFM. In the solver, Arc-length method is used. In order to use the program, below steps should be followed.

- To start solver, open "proje_v1.m" file and run it.
- After program started, user should import K, M, H and C matrices and enter all forces act on the system. (K, M, H and C matrices can be fully squared, upper-lower triangular matrix, column, or row matrix, and ready to use in .mat format)

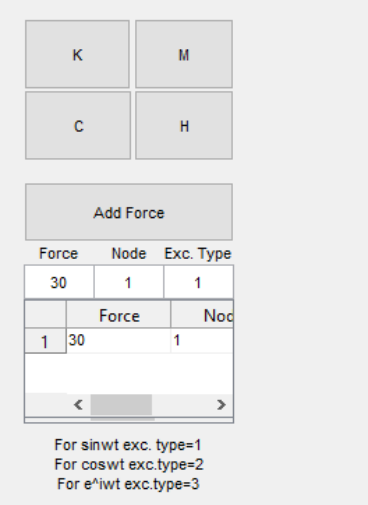

Figure 1

- User can calculate the natural frequencies (rad/s) at this step by pressing the "Calculate Natural Frequencies" button.

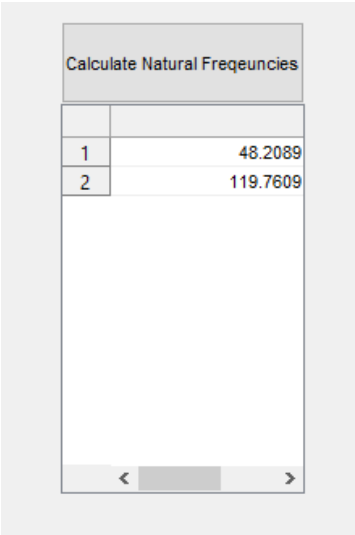

Figure 2

- Now, user can add nonlinear elements to the system as in showed in Figure 3.

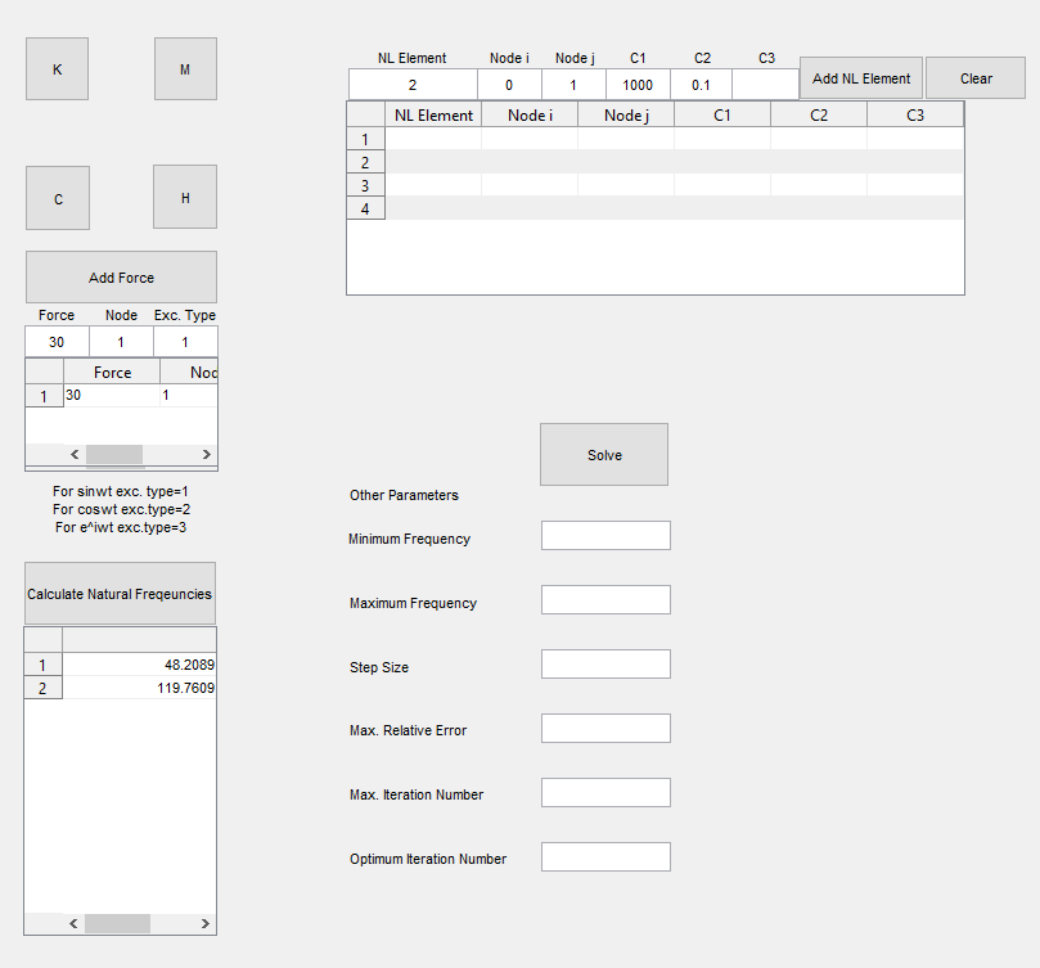

Figure 2

- For adding nonlinear elements and related parameters, Table 1. should be followed.

	NL ELEMENT	C1	C2	C3
CUBIC STIFFNESS	1	kc		
GAP NONLINEARITY	2	kg	delta	
PIECEWISE STIFFNESS	3	k1	k2	delta
DRY FRICTION	4	kd	muN	
CUBIC DAMPING	5	c_c		
SQUARED DAMPING	6	c_s		
SQUARED STIFFNESS	7	ks		

Table 1. Available Nonlinear Elements and Parameters

- After adding nonlinear elements, user should enter remaining inputs as in showed in Figure 3 and press solve. (**Step Size=0.005, Max. Iteration Number=30 and N_opt=2 are recommended values**)

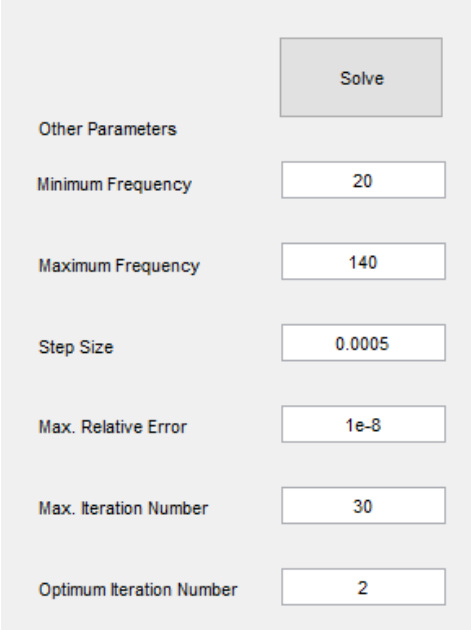

Figure 4

- When solution is done, plotting section will be appeared. User can enter mass coordinate, force coordinate and plot type for desired force normalized response before pressing “Plot” button. Also, responses of all masses (format is xs1 xs2 ... xsn xc1 xc2 … xcn) (responseresults.txt) and frequency interval of solution (frequencyresult.txt) can be exported to root directory of solver in .txt format by using “Export Response Matrix” and “Export Frequency Matrix” buttons.

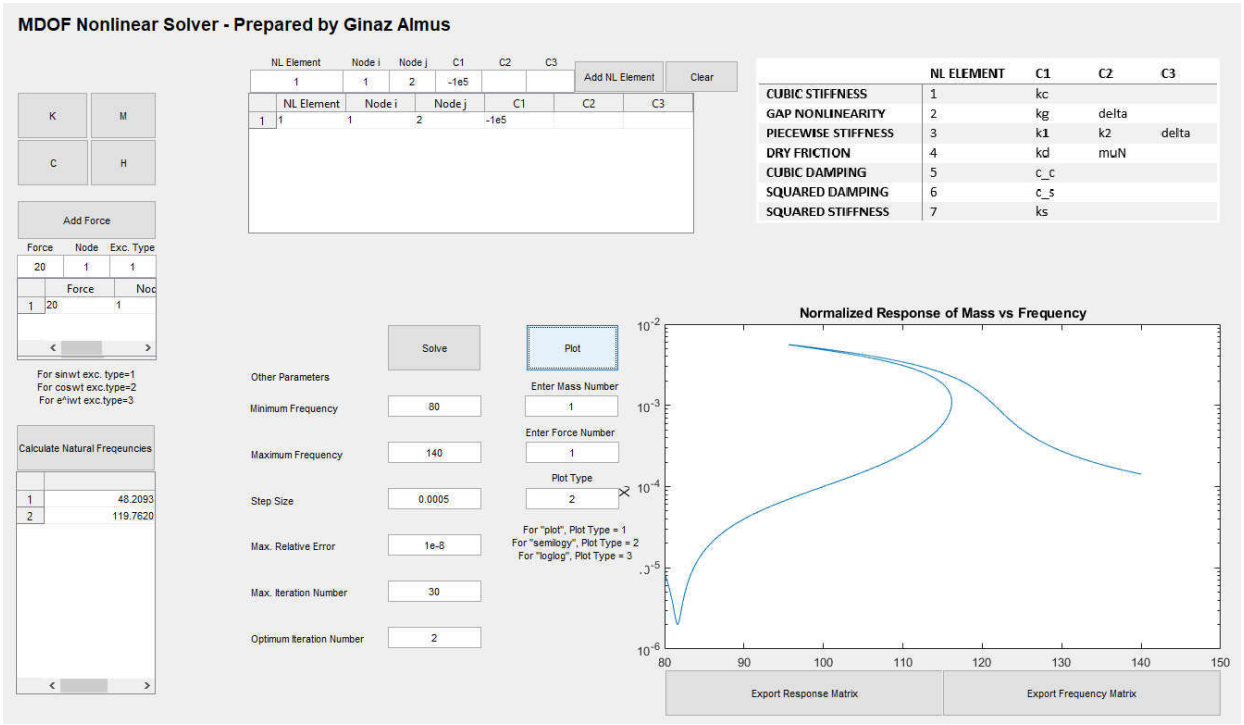

Figure 5