**INTRODUCTION**

Newton Harmonic Balance Method (NHBM) is applied to investigate frequency and response of the system with periodic behavior. Non-Linear oscillation problems are important issues in physical science, mechanical structures & engineering researches because most of the real problems are modelled by using Non-Linear differential equations. The vibration response, stability and frequencies are the basic terms in oscillatory systems. So, we carried out a small study on different Linear and Non-Linear systems. The main challenges associated with non-linear response are unpredictability of the amplitude, resonance (we can observe when driving frequency is almost equal to natural frequency), bifurcations of responses and chaotic responses. These are the erratic responses that are observed. So, the study of these type of responses in different ways like transforming into frequency domain (i.e., by using Harmonic Balance Method) or transforming into different co-ordinates may approximate the impossible calculations either analytically and computationally and resulting with converged solutions.

**DESCRIPTION**

Initially, Harmonic Balance method programming has done on the linear oscillating member to compare the results with the Analytical solutions. The equation that we have taken is,

The above equation is linear with a forcing function in sine terms. Our study is in discrete interval of times, so we considered some equally spaced points along time period by creating a sampled frequency (f). For this analysis, we have to consider the initial displacement/response function. Therefore, we considered

Initial response function, x=X \* sin (ω\*t)

Where, X = Amplitude of the Linear Differential Equation

ω = Driving frequency

t = Equal time space interval corresponding to the frequency

Initially, the entire variables have been declared globally for utilizing the variables in multiple functions without defining repeatedly. And continued with allocation of variables with numerals according to the requirement.

global N T w t F W X %Global declaration of variables

N=5; %Assumed number of points

T=2;

w=2\*pi/T;

t=linspace(0,T,N+1); %Equally divided points in continuous system

t=t(1:end-1); %N time interval in the current system

F=sin(w\*t); %forcing term

iw=(0:ceil(N-1)/2)\*1i\*(w);

miw=(-1i)\*(floor (N/2):-1:1)\*(w);

W= [iw, miw]; %Appending the frequency terms

X=fft (F); %Forcing term in frequency domain

Secondly, based on the equation we found the acceleration x

function residue=error()

dotX=W.\*X;

dotx=ifft(dotX);

ddotX=(W.^2).\*X;

ddotx=ifft(ddotX);

x0=ddotx/W.^2;

residue=@(X) sum (abs (ddotx+x0-F))