A09 Vibration calculator Assignment

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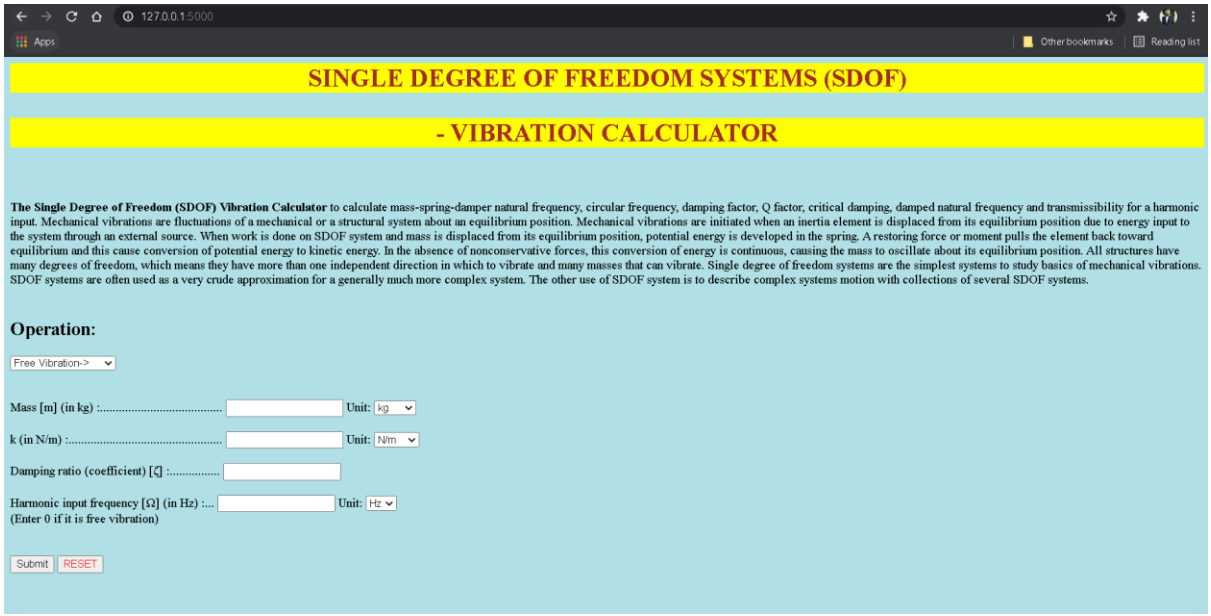
SDOF Free and forced vibration calculator

Single Degree of Freedom (SDOF) Vibration Calculator to calculate mass-spring-damper natural frequency, circular frequency, time period of oscillation, damping factor, Q factor, critical damping, damped natural frequency, damped natural angular frequency and transmissibility (if forced vibration) for a harmonic input.

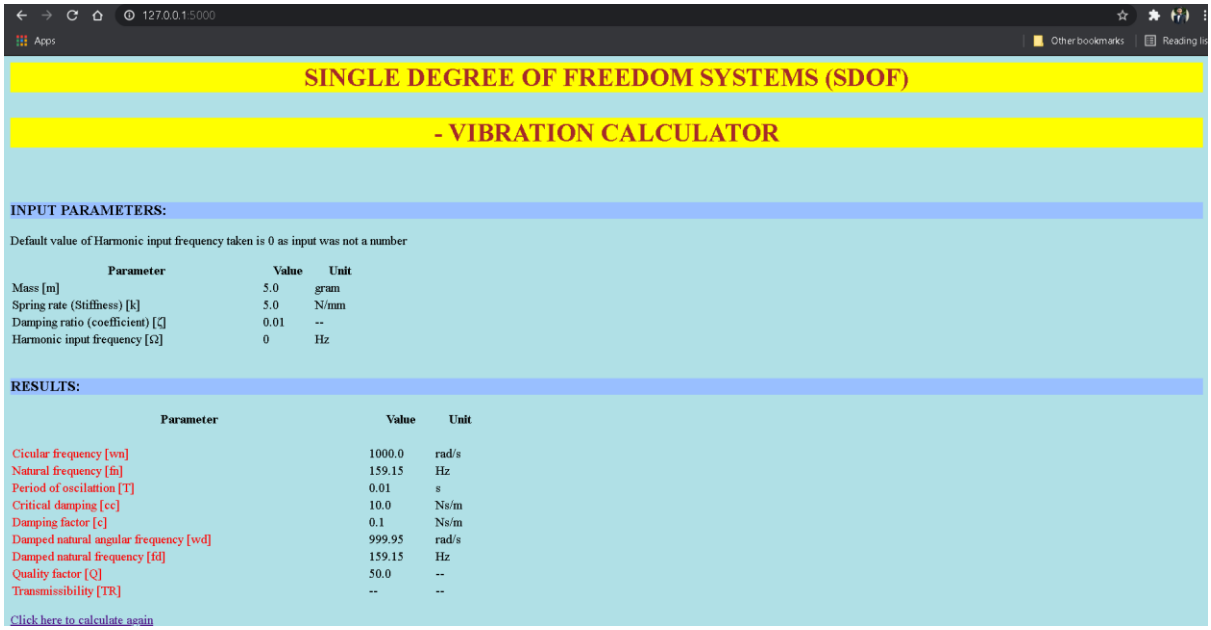
- At first it takes the option for free or forced vibration.
- Later the inputs for mass, stiffness, damping ratio and Harmonic input frequency (if forced vibration) is taken along with the specified units
- If the input is not a number or it is blank, then the default value of mass is 1 kg, stiffness is 1 N/m, damping ratio is 0.1 and Harmonic input frequency is 0 Hz.



Free vibration:

- The output is given. I.e. natural frequency, circular frequency, time period of oscillation, damping factor, Q factor, critical damping, damped natural frequency, Damped natural angular frequency
- For mass = 5-gram, stiffness = 5 N/mm, damping ratio = 0.01,

  The result obtained is below;



SINGLE DEGREE OF FREEDOM SYSTEMS (SDOF)

- VIBRATION CALCULATOR

INPUT PARAMETERS:

Default value of Harmonic input frequency taken is 0 as input was not a number

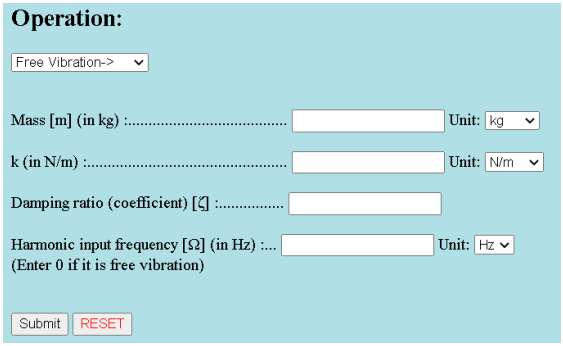
Parameter	Value	Unit
Mass [m]	5.0	gram
Spring rate (Stiffness) [k]	5.0	N/mm
Damping ratio (coefficient) [ζ]	0.01	--
Harmonic input frequency [Ω]	0	Hz

RESULTS:

Parameter	Value	Unit
Cicular frequency [wn]	1000.0	rad/s
Natural frequency [fn]	159.15	Hz
Period of oscilattion [T]	0.01	s
Critical damping [cc]	10.0	Ns/m
Damping factor [c]	0.1	Ns/m
Damped natural angular frequency [wd]	999.95	rad/s
Damped natural frequency [fd]	159.15	Hz
Quality factor [Q]	50.0	--
Transmissibility [TR]	--	--

Click here to calculate again

- If no input is given or the input is not a number then the output is given below;



Operation:

Free Vibration->

Mass [m] (in kg) :..... Unit: kg

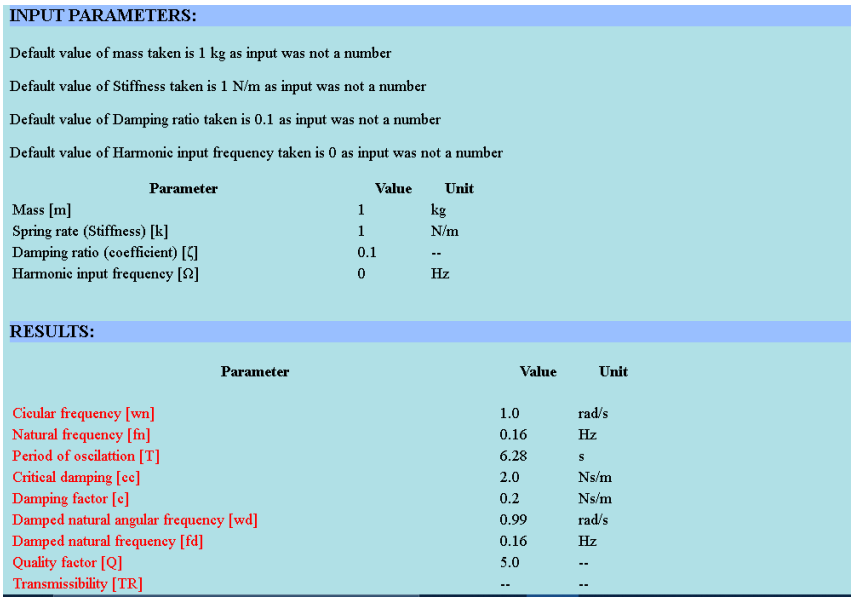
k (in N/m) :..... Unit: N/m

Damping ratio (coefficient) [ζ] :.....

Harmonic input frequency [Ω] (in Hz) :... Unit: Hz
(Enter 0 if it is free vibration)

Submit RESET

- Output will be displayed with default values in SI unit;



INPUT PARAMETERS:

Default value of mass taken is 1 kg as input was not a number

Default value of Stiffness taken is 1 N/m as input was not a number

Default value of Damping ratio taken is 0.1 as input was not a number

Default value of Harmonic input frequency taken is 0 as input was not a number

Parameter	Value	Unit
Mass [m]	1	kg
Spring rate (Stiffness) [k]	1	N/m
Damping ratio (coefficient) [ζ]	0.1	--
Harmonic input frequency [Ω]	0	Hz

RESULTS:

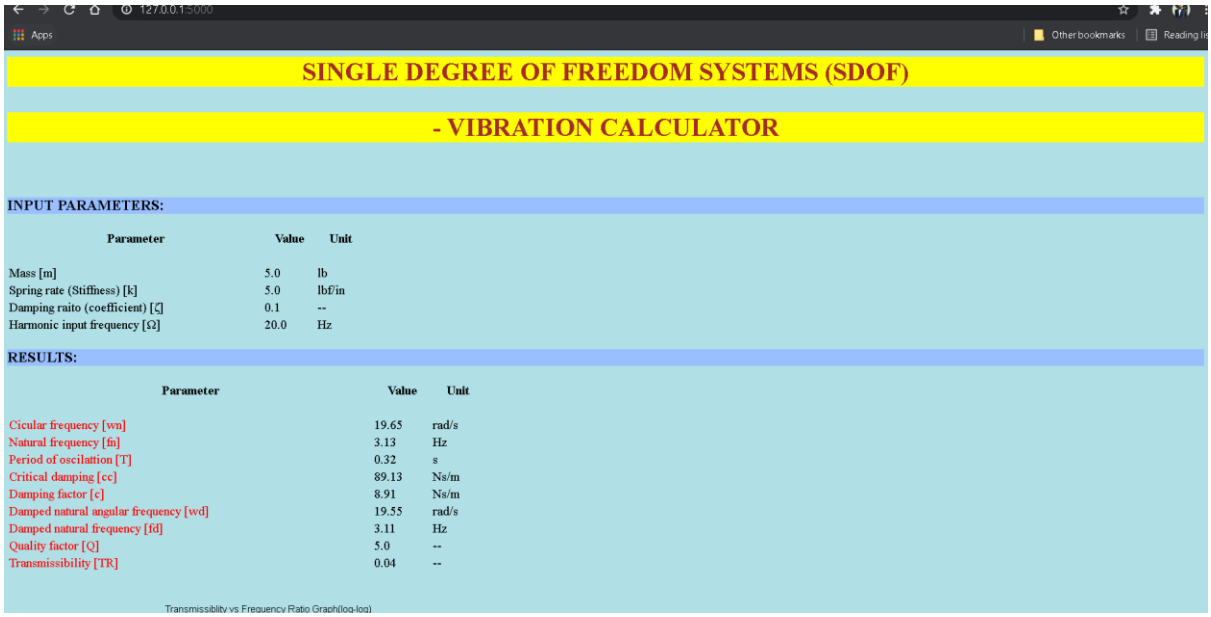
Parameter	Value	Unit
Cicular frequency [wn]	1.0	rad/s
Natural frequency [fn]	0.16	Hz
Period of oscilattion [T]	6.28	s
Critical damping [cc]	2.0	Ns/m
Damping factor [c]	0.2	Ns/m
Damped natural angular frequency [wd]	0.99	rad/s
Damped natural frequency [fd]	0.16	Hz
Quality factor [Q]	5.0	--
Transmissibility [TR]	--	--

- The same output will be there if the vibration is forced vibration with input harmonic frequency = 0

Forced vibration:

- The output is given. I.e. mass-spring-damper natural frequency, circular frequency, time period of oscillation, damping factor, Q factor, critical damping, damped natural frequency, Damped natural angular frequency and transmissibility for a harmonic input.
- A loglog graph of transmissibility vs frequency ratio is plotted.
- For mass = 5 lb, stiffness = 5 lbf/in, damping ratio = 0.1, harmonic input frequency = 20 Hz,

  The result obtained is below;



SINGLE DEGREE OF FREEDOM SYSTEMS (SDOF)

- VIBRATION CALCULATOR

INPUT PARAMETERS:

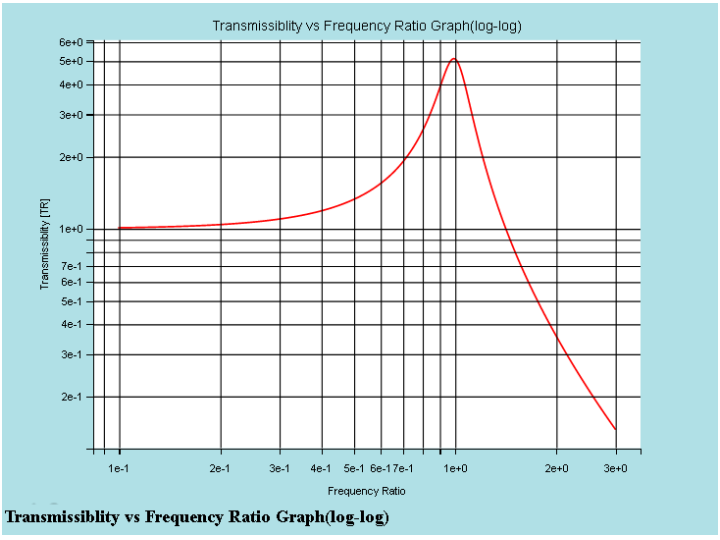
Parameter	Value	Unit
Mass [m]	5.0	lb
Spring rate (Stiffness) [k]	5.0	lbf/in
Damping raito (coefficient) [ζ]	0.1	--
Harmonic input frequency [Ω]	20.0	Hz

RESULTS:

Parameter	Value	Unit
Cicular frequency [wn]	19.65	rad/s
Natural frequency [fn]	3.13	Hz
Period of oscillattion [T]	0.32	s
Critical damping [cc]	89.13	Ns/m
Damping factor [c]	8.91	Ns/m
Damped natural angular frequency [wd]	19.55	rad/s
Damped natural frequency [fd]	3.11	Hz
Quality factor [Q]	5.0	--
Transmissibility [TR]	0.04	--

Transmissiblity vs Frequency Ratio Graph(log-log)

- The graph obtained is:



Transmissiblity vs Frequency Ratio Graph(log-log)

Process of programming:

- All coding is done in python and HTML is embedded inside python code only.
- I have used python flash. Flask focus on what the users are requesting and what sort of response to give back. The code lets us run a basic web application that we can serve, as if it were a website.
- The libraries required to run this program are flask, NumPy, math, matplotlib
- **Important:** The code has to run in the same host where the link is tested as flash here has not gone into any other website. It is in development. So the link(http://127.0.0.1:5000/) gets activated only if the code is run in the host computer with the required libraries.
- The code of this program(c.py) and the video file (SDOF CAL.mp4) is uploaded.
- The pdfs of all the pages is uploaded