Cantilever beam vibration report

Free vibration of Cantilever beam - Procedure PURPOSE Determine muted natural frequency, logarithmic decriminalization and decay coefficient of a system of free vibration reaction Rely on the mass of the system actively participates in the dynamics Determination of the equivalent viscous decay of the available in the system Clears critical decay of the system and insatiable natural frequency of the system GENERAL INSTRUCTIONS WE INSIST THAT THE USER READ THE INSTRUCTIONS "WELL BEFORE PERFORMING THE EXPERIMENT. ONLINE and OFFLINE MODES: In order for the user to conduct an experiment, they must be connected to nitk Surathkal's solve lab servers. For this purpose, the user must be in ONLINE mode. The user will be allowed to save the results of online experiments and use the same for further analysis in Offline mode. In offline mode, the user is not connected to the experiment. However, he/she can load a pre-saved data file to obtain the necessary graphics and perform additional data analysis. For this to happen, the user must have data saved from the same experiment. See step 6 below in the data download procedure. Control and View modes: In ONLINE mode, depending on the presence of an experiment, the user may receive CONTROL or VIEW mode. In CONTROL mode, the user is given to control the parameters of the experiment and trigger the experiment. In VIEW mode, the user will not be able to control the experiment or trigger it, but will receive the data acquired during the experiment. The graph will load on the screen after the data collection is complete. The VIEW user can choose to continue until the calculations with the received data. Only one user can be in CONTROL mode at any time. Allowed actions during Remote Trigger: While doing the experiment, i.e. when the user is in the Remote Trigger window, right-click only in the chart area where the context menu will give options to zoom in, decrease, save as image, etc. Updating pages results in a loss of connection to the experiment server. However, users can move back and forth between the PROCEDURE tab and the Remote Switch tab while making calculations if they need to refer to the formula given in the table below. Note The remaining time and the number of attempts that are left are displayed in the metric block. If the time has come or the number of attempts remaining is zero, the user automatically disconnects from the experiment server. FORMULA Effective mass cantilever beam concentrated at the free end is 0.23mbeam. So for this experiment m=msensor + 0.23mbeam PROCEDURE: Fig. 13. (b) an equivalent engineering model; (c) System with ciliculated parameters 1. To conduct the click Start. To load pre-saved data, click Select file and find the file. A pop-up dialog box will inform you about successful data loading. You can access the graphics and continue with the calculations after you click OK (Go to step 4 for calculations) 2. Once connected to the experiment server in CONTROL mode, you can perform the experiment. Depending on availability, control or VIEW mode will be provided. If you received VIEW mode will be placed in queue and the waiting time for receiving slot control will be displayed. You can wait or choose to use the data received during the current session to continue with the calculations (Step 4) 3. Click on Trigger to trigger an electromagnetic. The electromagnetic will attract and leave the free end of the cantilever beam, due to which the cantilever beam will be set to free vibration. Accelerometer acceleration data will charge a little on your screen. After you receive the data, you can choose to REACTIVATE or disconnect from the experiment server. The number of attempts remaining and the remaining time to complete the experiment are shown in the indicator block. 4. Click Continue to the Calculations button to go to the calculation window. Known parameters are listed below graphs. Hover over a point in the chart to find its coordinates x and y. Use the available values to calculate the listed parameters and enter them into appropriate fields. During calculations, the user can turn to the formula table given under the formula heading above. 5. Click the Send Calculations and View Results button to send your data. ONCE THE ANSWERS PROVIDED CANNOT BE RETURNED. A pop-up window will ask for confirmation to send the result. Click OK to continue. Click CANCEL if you want to check your data. 6. Click the Download Data button below the chart to download and save your data. You can use this file to load the graphic and continue with offline calculations. 7. You can also save your results (for your record) by clicking Download Results. You will receive a CSV file containing the data from the results table. 1. Mohammed Usman Assignment 1 2015-ME-12 Mechanical Vibrations 7th Semester page 1 of 16 vibration analysis and modeling of cantilever beam Student Details your full name Mohammed Uman registration No. 2015-ME-12 Summary This report in cooperation with the techniques adopted to evaluate the vibration analysis of a cantilever beam, using both theoretical and practical. Computer beam analysis is also carried out using solid works and Matt Lab software. These techniques help a lot in finding natural frequencies and in making the vibrational characteristic behavior of a cantilever beam, so that the steel used as a material. As the whole investigation was carried out, the true response to the vibration system was monitored and it was found that all the analyses carried out were up to the mark. Although there were some inconsistencies in the indications when theoretical and experimental techniques have been compared with each other, but it has been recognised that these analytical techniques are still considered sustainable in the performance of vibration vibration cantilever beam. 1. Introducing the central preservation of this study shall be to make a vibrational analysis of a cantilever beam, thereby adopting certain methods which may assist in the calculation and validation of the results obtained from experimental as well as theoretical analysis. Initially, the experiment was carried out when collecting all related data on the vibrational behavior of the cantilever beam, after which it was verified by the mathematical values and theoretical calculations. [1] Furthermore, in order to ensure the results and validation of our calculations, computer analysis and simulations must be carried out using certain software. In computer analysis of solidWorks, the software was used to simulate the purpose of the console beam, while the Mat Lab software serves the purpose of data collection and depicts graphics. Many studies are done in the assessment of parameters that mainly affect the indications of the beam. The mass of accelerometers is considered to be one of those important parameters that impair the values of the natural frequencies of the cantilever beam according to its alignments and location. [2] Damage detection techniques in structures are either mechanically built or civilly vital in this era. Fields such as mechanical engineering, Aerospace and civil engineering play their final efforts in pre-determining and detecting changes or effects in the structure. Some techniques have been adopted to monitor the responsibility of the system, thereby reducing the life cycle of the mechanical structure. Conventional accepted techniques can take time, expensive and can be somewhat effective, so alternative vibration analysis techniques are performed for all calculations. Computer software such as Solid Works was used for simulation and Matt Lab to collect the data and perform the calculations according to requirements, after which these results were compared with handmade calculations. [4] 2. Mohammed Usman Task 1 2015-ME-12 Mechanical Vibration 7 Semester Page 2 of 16 2. Literary review 2.1. Free and force vibrations are vibrations in which the amplitude remains the same, i.e. the total energy of the vibrating system remains constant in relation to the time period. Since these ideas are theoretical, there are practically no such systems that have free vibrations due to the continuous release of energy called a shock absorber. Below is the picture of perfectly free vibrations. 1 The pristen vibrations of vibrations are those requiring continuous external force performance in the performance of the vibrations of the system at a certain frequency. Each object tends to vibrate at its specific frequency, called natural frequency. [6] When due to the application of external force, the body moves the tendency to move with its natural frequency is called resonance, which is depicted in figure below: Figure 2 Resonance 2.2. The factor of increase in the system factor is determined in relation to the ratio of vibrating systems, i.e. when the gradient frequency approaches the resonant frequency of the vibrating system, the amplitude of the resulting system becomes greater, which is expressed in the magnification factor. [7] 3. Muhammad Usman Task 1 2015-ME-12 Mechanical Vibration 7th Semester Page 3 of 16 Figure 3 Factor Zoom Fig. 4 Graph between Magnification Factor and Frequency Ratio 2.3. The Euler-Bernoulli Beam Theory For calculating the characteristics of bending and carrying the beams was proposed by Euler and Bernoulli, which is also known as the beam engineer theory or for some time called classical beam theory. The deformation of the beam is obtained for the loads, which are applied only in a lateral direction. [8] It includes two main forms that the beam material must first be elastic, that it follows the Hooks Act, the second planes must remain flat and must be perpendicular to the neutral axis. 4. Mohammed Usman Task 1 2015-ME-12 Mechanical Vibrations 7th Semester Page 4 of 16 3. Methodology The cantilever beam is made of flat carbon steel of certain sizes. This includes a width of 25.4mm by 3.2mm and a length of 410 mm. One end of the beam is fixed with a support, while the other end is free to collector so makes it a cantilever beam. The beam was analyzed and the vibration analysis was done using a mass and without mass. The data was provided in The Labora View after conducting a series of experiments and values were recorded on a cantilever beam for cases they used and without using mass. Analytical approach The canine harness has been analytically analyzed. All calculations were made by hand, and finally the results were obtained at different frequencies. Experiments After collecting the data from Cantilever Beam, all data was imported into the Matt Lab software file. Then the code is written and the parcels are made of a cantilever beam for use and without using the table. The frequency graphs and time spectra of the cantilever beam are made using and without the use of mass, as well as for frequency mechanical (9). The solidWorks software was used to analyze the final elements of the beam. Beam is modeled and designed in SolidWorks, the length, width and thickness are taken respectively 410, 25.4 and 3.2 mm. The beam is fixed at one end and carbon steel is used as material Simulation is carried out under a frequency area. The network was created, the simulation was carried out and the study was analyzed with both mass and no mass. 4. Results [4] 4.1. Laboratory examination results The results of the laboratory examination were obtained after performing the experimental analysis of the cantilever beam when connected to the computer and setting the entire setting. 4.2. Analytical results the calculations are carried out using the formulae and the results for the cantilever beam are obtained as follows, taking into account the mass and without taking into account the mass. Table 1 Analytical results Beam without mass Beam with mass ωn 1 15.93ωn 1 9.697 ωd 1 15.95 ωd 1 9.70 ωd 2 ωn 1 99.53 ωd 1 99.49 ωn 1 276.023 ωd 1 275.993 5. Mohammed Usman Task 1 2015-ME-12 Mechanical Vibration 7 Semester Page 5 of 16 4.3. Experimental results Experimental setting was built by examining the console beam, accelerometer, some vibration initiators (shaker), amplifier, frequency generator and pc attached with lab review software, etc. The setting is shown in the figure below: - Fig. 13. Mohammed Usman Task 1 2015-ME-12 Mechanical Vibration 7th Semester Page 6 of 16 4.4. Matlab results in Matt Lab software values derived from the data are encoded and are drawn to obtain certain graphs that are displayed. The code for the beam without mass is given below: data =read table (Beam without mass.txt); Time =data. Time_s_; Offset = data. Displacement_V_; stretch (time, displacement, 'o') grid of the title (Beam response time without mass); xlabel (Time(s)); ylabel (Offset (mm)' data = displacement; Fs =500; 2^16; X=fft(Data, nfft); X=X(1:nfft/2); mx=abs(X); f=(0:nfft/2-1)*Fs/nfft; section (f, mx,'b') xlim ([0,25]) heading (frequency characteristic of the beam frequency band without mass); xlabel (frequency (Hz)) ylabel (dimension) of the graph are as follows: - 7. Mohammed Usman Task 1 2015-ME-12 Mechanical Vibrations 7th Semester Page 7 of 16 Fig. Mohammed Usman Assignment 1 2015-ME-12 Mechanical Vibration 7th Semester Page 8 of 16 The code for the Mass Beam is as shown in the table below: - data=table table (Beam with table.txt); Time =data. Time_s_; Offset = data. Displacement_V_; stretch (time, displacement, 'o') grid of the title (response time of beam with mass); xlabel (Time(s)); ylabel (Offset (mm)' data = displacement; Fs =500; 2^16; X=fft(Data, nfft); X=X(1:nfft/2); mx=abs(X); f=(0:nfft/2-1)*Fs/nfft; section (f, mx,'b') xlim ([0,25]) heading (frequency characteristic of the frequency range of a beam with mass); xlabel (yss)) ylabel (dimension) in Figure 8 Beam response in time domain 9. Mohammed Usman Task 1 2015-ME-12 Mechanical Vibrations 7th Semester Page 9 of 16 Fig. Mohammed Usman Task 1 2015-ME-12 Mechanical Vibration 7th Semester Page 10 of 16 Fig. 16 11 Response to beam in frequency area The beam code ranging from 5 to 300 Hz is as specified in the table below: - data = readable (Beam of 5-300 Hz.txt'); Time =data. Time_s_; Offset = data. Displacement_V_; stretch (time, offset, 'o') heading grid (Response to the time domain for frequent purge); xlabel (Time(s)); ylabel (Offset (mm)' data = displacement; Fs =500; 2^16; X=fft(Data, nfft); X=X(1:nfft/2); mx=abs(X); f=(0:nfft/2-1)*Fs/nfft; section heading (f,mx,'b') (frequency bandwidth for meta frequency check); 11. ylabel (Magnitude) at 11. Mohammed Usman Task 1 2015-ME-12 Mechanical vibration 7 semester Page 11 of 16 Fig. SolidWorks Results After simulation were performed in solid works software and the results are as follows in the figures below: - Cantilever Beam without mass 12. Mohammed Usman Task 1 2015-ME-12 Mechanical Vibrations 7th Semester page 12 of 16 Fig. Mohammed Usman Assignment 1 2015-ME-12 Mechanical Vibrations 7th Semester Page 13 of 16 Fig. 16 Mohammed Usman Assignment 1 2015-ME-12 Mechanical Vibration 7th Semester Page 14 of 16 Beam 239.79 Hz Fig. 19 Beam at 469.98 Hz Comparison table: - Below is the table for comparing the values of the results obtained from the experiment, theoretical and analysis, Made by the software such as Solid Works Mat and Lab. No mass of applied theoretical matte laboratory hardness experiment ωn 1 15,93 16,01 ωd 1 15,95 11,69 12,207 ωn 2 99,53 100.0 39 ωd 2 99.49 81.521ωn 3 276.023 280.77 ωd 3 275.993 212.646 15. Mohammed Usman Assignment 1 2015-ME-12 Mechanical Vibration 7 Semester Page 15 of 16 Table 3 Comparison between different results without mass attached to the cantilever beam with applied mass theoretical matt laboratory solid works Experimentation ωn 1 9.697 10.3 05 ωd 1 9.702 9.598 10.114 ωn 2 239.79 ωd 2 ωn 3 ωn 3 469.98 ωd 3 Table 4 Cantilver without attached table 5. Discussion In this study, the vibrational analysis of a plane carbon steel cantilever beam was analyzed under both conditions, i.e. mass attached and without mass hanging using some analysis tools. First, the experiment was carried out to check the results of ours, the use of Matt Lab and the Solid Factories made it easier to work in finding the right values. The analysis carried out for the beam without the attached mass was quieter because it did not take time and a lot of results were obtained, and for the beam to which the mass was applied, the analysis carried out is a little difficult task. The table drawn above presents a clear picture of the experimental results, the analytical results obtained from manual calculations and the results obtained from the software analysis, i.e. Matt Lab and Solid Works. The errors were derived from the results by assessing the experimental cantilever beam results when no mass has been attached. About 23.46%, 18.06% and 22.95% were errors received at different frequencies. Results obtained from the Solid Works simulation give 0.502%, 0.864% and 1.71% error from Solid work and analytical readings. Similarly, the error received when comparing matt lab's score and analytical readings was 26.70%. The percentage errors of a cantilever beam with attached mass are obtained from the evaluation of the results of the analysis with experimentation, solid works and matte laboratory values are as follows, i.e. 4.24%, 6.26% and 1.07% respectively. 6. Conclusion The main perseverance of this study is to make an analysis of the cantilever beam under vibrations. To this end, different methods were adopted, i.e. experimental analysis, Matt Lab, FEA Analysis and all results were compared taking into account the first three natural frequencies with their graphs. Although there were some errors in the data collected after analysis and experimentation, i.e. the values deviated from their results 16. Mohammed Usman Task 1 2015-ME-12 Mechanical vibration 7th semester Page 16 of 16 and ignoring the mass of accelerometer also caused the errors, but the rest of the collected were to the required desire and they had few inconsistencies. Thus, if errors need to be cancelled, then the accelerometer mass should be considered to obtain more acceptable results. So, this can be minimized by modeling our object ie. Cantilever Beam some analysis software. Here Solid Works has been used as simulation software and given the accelerometer mass errors are quite low. The sole purpose of this analysis and examination of a cantilever beam is to make an understanding of the vibrational analysis of this beam using the mass attached and using without mass. References 1. S, M., K.G.B S and D. S Prakash, VIBRATIONAL ANALYSIS OF A CONTILE BEAM OF VARIOUS MATERIALS. 2018. 2. Gavriloski, V. Vibration analysis of a fault line 2015 12/01/19]; Available from: beam_for_damage_detection. 3. GABROV, C. DYNAMIC ANALYSIS OF ROTATING CANTILEVER BEAM BY THE END ELEMENT METHOD. 2001 14/01/2019]; Available from: . 4. Wu, J-S. and T.L. Lin, Free vibration analysis of the same cantilever beam with point masses by analytical numerical-combined method. 136. 1990. 201-213. 5. Blake, R.E. BASIC VIBRATION THEORY. 2015 14/01/2019]; Available from: 20Theory.pdf. 6. Jola, L. Comparison of the calculations of the interaction between soil and structure with the results of full-scale forced vibration impact tests. 1987 14/01/2019]; Available from: 88)80012-5. 7. Gil Martin, L.M. sdof oscillators under a harmonious load. 2010 14/01/19]; Available from: . 8. Tarazona, A.O. Euler-Bernoulli-Beams. 2017 12/01/19]; Available from: . Bert.C. Material decay: an introductory review of mathematical measures and experimental technique. 2006 14/01/2019]; Available from: 73)80131-2. 10. Khas, H. Bending and free vibration response to the layer functional beams: Theoretical model and its experimental validation. 2007 14/01/19]; Available from: . .