INDIAN INSTITUTE OF TECHNOLOGY, GUWAHATI

CE 607 – Random Vibration

Date of submission: 20th March 2016

Total Marks: 80

Note: Submit report & codes. Assume any other data that you feel relevant and clearly mention in the report.

Problem 1

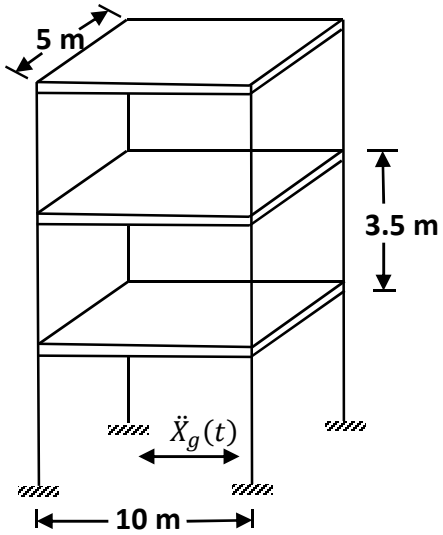

Figure 1

Above frame has 100mm thick slab with grade of concrete M25. The column size is 200mm*200mm. $\ddot{X}_g(t)$ is modelled as zero mean Gaussian process with Kanai-Tajimi spectrum with $\omega_g = 20\, rad/s$ and $\xi_g = 20\%$

a) Check the base column against shear and evaluate the failure probability.
b) Design the column against inter-story drift for a $p_f = 0.001$. Allowable inter story drift is $h/_{250}$.
c) Validate all your results using time domain simulation.

Problem 2

1. $y(t) = \cos 5t$
2. $y(t) = e^{-0.5t}(\sin 10t + \cos 15t)$
3. $y(t) =$ Band limited white noise
4. $y(t) = e^{-0.5t}$

Evaluate the auto correlation in each case and plot them. Select band width of your choice.

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Problem 3

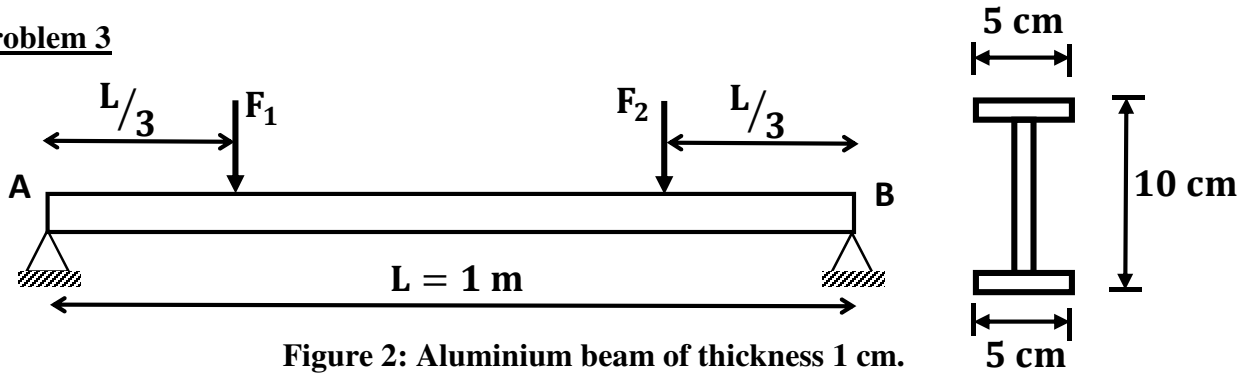

Figure 2: Aluminium beam of thickness 1 cm.

F_1 and F_2 are modelled as a un-correlated Gaussian white noise of intensity I and 0.75I respectively. Develop the model for bending stress and shear stress. Design the intensity of the load for a p_f of 10^{-4}.

Problem 4

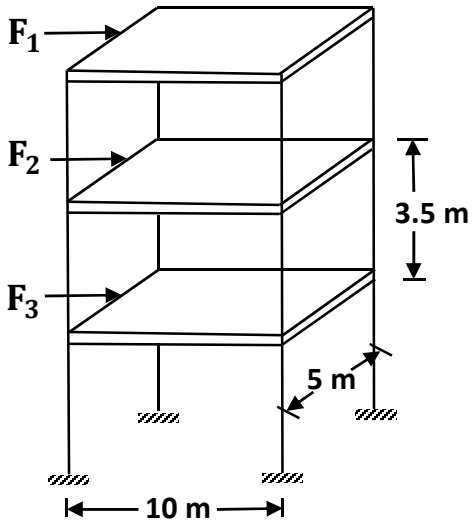

Figure 3

Evaluate peak rms value of the combined shear and bending stress at the base column of the frame shown in figure 3 and compare with time history simulation. Loads are zero mean Gaussian white noise of equal intensity. Design the structure for a failure probability of 1E-4. (Note: shear building assumption is not enough). Other properties are same as on Figure 1.