Probabilistic Analysis of Lateral Displacements of Shear in a 20 storey building
Samir Benaissa¹, Belaid Mechab²
1- Laboratoire de Mathématiques, Université de Sidi Bel Abbes BP 89, Sidi Bel Abbes 22000, Algerie.
2- LMPM, Department of Mechanical Engineering, Université de Sidi Bel Abbes BP 89, Sidi Bel Abbes 22000, Algerie.
benaisamir@yahoo.fr
doi:10.6088/ijcser.00202010029

ABSTRACT
This study presents a probabilistic methodology analysis of a lateral displacement of shear wall structures strengthened by bonded composite plate. This methodology was developed for predicting probabilistic characteristics for the effect of the bending and vibration analysis of shear wall structures strengthened by bonded composite plate, the Lateral displacements of shear wall (SWII) analyzed by finite element method.

Keywords: Probabilistic, vibration strengthened shear wall, Finite element method, Composite plates

1. Introduction

In many areas around the world, reinforced concrete (RC) buildings designed using codes that are now known to provide inadequate safety under seismic forces are potential hazards. In such areas, the number of RC buildings built prior to 1980 outnumbers those that are built according to the newer codes. Therefore, these structurally deficient buildings should be retrofitted to withstand earthquake forces in compliance with modern design codes.

The lateral loads that arise from the effects of wind and earthquakes, are resisted by shear walls. These latter, are usually built over the whole height of the buildings, as series of walls coupled by beams or slabs or as a central core structure. Pagnini and Solari used the first-order and the second-order techniques in computing the acceleration response of a square plan multistory steel building excited by the wind loading. Obviously, the main purpose of these methods is to determine the second-order statistical quantities of dynamic structural response, such as the mean, the standard deviation, etc. As far as the probability density function (PDF) of the response is concerned, most of these methods will be met with difficulty. Extensive testing has shown that externally bonded carbon fiber reinforced polymer (CFRP) laminates are particularly suited for improving the short-term behavior of deficient reinforced concrete beams and slabs. Also note that this technique of reparation has been also used in aircraft structures.
This study presents a probabilistic methodology analysis of a lateral displacement of shear wall structures strengthened by bonded composite plate. This methodology was developed for predicting probabilistic characteristics for the effect of the bending and vibration analysis of shear wall structures strengthened by bonded composite plate, the Lateral displacements of shear wall (SWII) analyzed by finite element method.

2. Geometrical and mechanical properties

The numerical values of the geometrical and material parameters were presented in Table 1 and Figure 1 for shear walls structures: SWII.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass density $q$ (kg/m$^2$)</td>
<td>2400</td>
</tr>
<tr>
<td>Young’s modulus $E_{11} = E_{22}$ (GN m$^-2$)</td>
<td>15</td>
</tr>
<tr>
<td>Shear modulus $G_{12}$ (GN m$^-2$)</td>
<td>6.25</td>
</tr>
</tbody>
</table>

![Figure1: Shear wall structure SWII un-strengthened](image)

3. Numerical results and discussion

Numerical results are presented in this study analyzed by finite element method for shear walls strengthened by a bonded composite thin plate. We consider in the first example the free vibration for typical unstrengthened shear wall structure. Results of method are listed in Table 2 and compared with those of Syngellakis and Papoulia. It can be seen
The dimensions of shear wall structure SWII Strengthened and unstrengthened are shows in Figure 2 the results presented in Figure 3.
Figure 3: Lateral displacements of shear wall (SWII).

Figure 3 shows the effect of the bending and vibration analysis of shear wall structures strengthened by bonded composite plates and unstrengthened can be observed. The lateral displacement of shear wall (SWII) is proportionally with height.

4. Probabilistic analysis

4.1. Probabilistic results and discussions

This study presents a probabilistic methodology analysis of a lateral displacement of shear wall structures strengthened by bonded composite plate. This methodology was developed for predicting probabilistic characteristics for the effect of the bending and vibration analysis of shear wall structures strengthened by bonded composite plate, the lateral displacements of shear wall (SWII) analyzed by finite element method.

In this paper a method is presented to calculate the probability of a problem, of which one or more of the model parameters are random variables, i.e. statistically determined. Mathematically this can be stated as:

\[ F_U(j_o) = \Pr[j_o < j_o] = \int_{U(X) < j_o} f_x(x)dx \]  

(14)
f(x) the Joint Probability Density Function (JPDF) of the vector of random variables X, such as material parameters, dimensions and loads. The displacement U should be evaluated by the probability or the probability density.

\[ f_U(j_0) = \frac{dF_U(j_0)}{dj_0} \]

Where \( F_U(j_0) \) is the cumulative probability distribution function of U and \( f_x(x) \) is the known joint probability density function of X. Figure 4 presents similar results of probability Gaussian distributions of random variables.

U: Lateral displacements of shear wall structure (SWII).

**Figure 4:** Presents similar results of probability density of U

4. Conclusions

This study presents a probabilistic methodology analysis of a lateral displacement of shear wall structures strengthened by bonded composite plate. This methodology was developed for predicting probabilistic characteristics for the effect of the bending and vibration analysis of shear wall structures strengthened by bonded composite plate, the Lateral displacements of shear wall (SWII) analyzed by finite element method.

The Effect of the bending and vibration analysis of shear wall structures strengthened by bonded composite plates and un-strengthened can be observed. The Lateral displacement of shear wall (SWII) is proportionally with height. Probability density functions of U see Figure 4 presents similar results of probability Gaussian distributions of random variables.
References


