Pengolahan Sinyal Respons Struktur yang Bergetar Aplikasi pada Masalah Vibrasi Pelat Tipis

Heru Purnomo, author

Abstrak

Physical behavior of models can be measured in the laboratory, which, in turn are often used to assess the behavior of more complicated structures. Mechanical responses present physical behavior of a structure. By using three different transducer, one can measure acceleration, velocity and displacements directly. Determination of velocity and displacements from acceleration data is preferable from point of view economics; but on the other hand this procedure, at present, is still causing problem. This study shows that displacements and velocity can be calculated from its acceleration which is obtained by using one transducer.

The acceleration data are obtained from a cantilever steel plate which is subjected to a transient force at a discrete location on its surface or an initial deflection on its tip. An acquisition program was first designed before starting the experimental program. By means of a piezoelectric accelerometer, a conditioning amplifier and a digital oscilloscope, acceleration data are captured and then transferred to a personal computer.

The transformation of these two responses, displacements and velocity from the acceleration data are performed in two domains, time domain and frequency domain. Two integration techniques, Newton-Cotes formula and Simpson's rule were used for the calculation in the time domain. For both techniques, adjustment of basis line is performed by End Zero Time Technique Modified. Programmation has been done for both types of domain analysis.

The Simpson's rule gives sufficient results and Newton-Cotes formulation gives good results only for moderate values of Cotes coefficient. High values of the coefficient give unrealistic calculated velocity and displacements. Drifting character are present on the displacements calculated by both methods.

In the frequency domain, the velocity and displacements are obtained from acceleration data by means of Fast Fourier Transform and its Inverse Fourier Transform. This method give satisfactory results only for the calculation of velocity. The displacements obtained show also drifting character. Nevertheless, realistic forms of this displacements are moderately accepted.

Results comparison of the two methods, both in time domain and frequency domain, show that none of the method is better than another. Analysis in frequency domain give more accurate results, but this method is not definitely a principal method for the solution of this type of problems. The two methods shall be used for the calculation of velocity and displacements. This procedure can verify one result to another to avoid wrong interpretation of transformed responses.