OPEN ACCESS Freely available online

ISSN: 2168-9873

Journal of Applied Mechanical Engineering

Commentary

Experimental Modal Analysis of Mechanical System

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DESCRIPTION

The dynamic analysis of structure is very important as it predicts the response of structure under different conditions. As the structures are becoming more and more complex due to advanced materials and manufacturing techniques, the dynamic analysis is also becoming complex and the behavior more complicated to observe. The vibration characteristics of structure are very important to study as they help to reduce noise levels, increasing life span of structure and even product certification and reliability needs. industrial requirements need dynamic behavior to be precisely judged under various loading conditions and environments. This also gives companies edge over others in today's cut throat competition.

The structural dynamics of any mechanical structure are composed of frequency and position. This can be clearly observed by solving the partial differential equation of any continuous system which is available in text for structures like beams, strings and shells, etc. Model analysis is based on the basic assumption of model analysis is that the vibration responses are linear combinations of simple harmonic motions known as 'the natural modes of series which is a combination of Sine and Cosine waves which in turn represent a complicated wave formed. The natural modes of vibration are the inherent properties of a dynamic system and depends entirely on the physical properties and their distribution as well as connectivity. These properties are responsible for the dynamic behavior of system.

Each mode of the system is described in terms of natural frequency, damping factor and displacement which are collectively termed as model parameters. The mode shapes thus observed may be real or complex which in turn depends on the type of damping present in the material or structure under test. These modes correspond to a natural frequency. The overall vibration of a system depends on the dependence on each mode and excitation source. The dynamic analysis is broadly classified in two main groups namely analytically modelling and experimental techniques. The Finite Element Method (FEM) is an analytical method used for prediction of the dynamic behavior of structure. This method requires a finite element model of structure which is a typical CAD model and does not require any experimental technique or structural testing. As no physical model is used in this method it is relatively simple, fast and cheap method of analyzing the systems response.

On the other hand, the experimental methods determine the structures response through the dynamic test on real structures. As the testing requires real structures it is a costly process requiring time sand at times may not be accurate due to experimental errors and skills requirements. Both the above methods have their own advantages and disadvantages.

CONCLUSION

The analytical modeling is widely used due to its cost effectiveness and simplicity however finite element results are often questioned due to their inconsistent results. Model updating techniques termed as Finite Element Model Updating (FEMU) are used to update finite element models for accurate prediction of dynamic response of structure. Most of the engineering structures are made of thin beam and plate elements. They are used in different shapes and configurations to make a complex structure hence their correct dynamic behavior needs to be investigated for accurately prediction of response of complex structure. Finite element analysis is well known technique for modeling of large and complicated structure and to predict dynamic behavior in order to reduce the cost and time. The use of finite element modeling is increasing day by day in industry for dynamic analysis of structure. This approach has reached to certification level in aerospace and automobile industry.

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Received: 02-Sep-2022, Manuscript No. JAME-22-18502; **Editor assigned:** 05-Sep-2022, Pre QC No. JAME-22-18502 (PQ); **Reviewed:** 20-Sep-2022, QC No JAME-22-18502; **Revised:** 26-Sep-2022, Manuscript No. JAME-22-18502 (R); **Published:** 04-Oct-2022, DOI: 10.35248/2168-9873.22.11.438.

Citation: Roth M (2022) Experimental Modal Analysis of Mechanical System. J Appl Mech Eng. 11:438.