DOCUMENTATION SHEET

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Title : A Method for Dynamic Characterization and Response Prediction using Ground Vibration Test (GVT) Data for unknown structures.

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Division : Structures | **NAL Project No. :** S – 0-247

Document No. : PD-ST-0705 | **Date of Issue :** March 2007

Contents 46 | **Pages** 17 | **Figures** 11 | **Tables** 12 | **References**

External Participation : -

Sponsor : CEMILAC

Approval : Head, Structures Division 24/04/07

Remarks :

Keywords : Dynamic Characterization, Experimental Modal Analysis, Normal Modes, Natural Frequency, Damping, Scaled generalized stiffness and mass, Modal and Point Impedances, Harmonic and Transient response.

Abstract:

The objective of this proposed work is to develop a reliable method for dynamic characterization and prediction of dynamic response of structures of known/unknown configurations, by processing the free vibration data generated experimentally from the Ground Vibration Tests (GVT) of the prototype vehicles. The methodology would make use of the measured dynamic data in terms of mode shapes, natural frequencies, modal damping, point impedances etc. and generate modal (scaled) stiffness and inertia information that will be used for prediction of response characteristics of the prototype structure.

With these objectives, the present work develops the mathematical formulation of the method, and demonstrates its reliability by performing the experiment on a simple cantilever beam to determine its dynamic characteristics. Results on scaled modal stiffness and inertia, generated through the method using experimental (GVT) data show excellent agreement with those generated by FE and analytical models. It must be noted that a valid benchmarking is performed with the condition that the experimental procedure is 'blind' to the actual stiffness and inertia distributions as used in FEM or analytical models. Agreement of the predicted response of the structure with that from direct experiment and those from the FE and analytical models indicates that this method will be a promising tool to predict the dynamic and aeroelastic characteristics of any prototype vehicle in the future.

Once the reliability of the method is established, it can be extended to determine the dynamic and aeroelastic characteristics of all aircraft for which dynamic characteristics are available from a Ground Vibration Test (GVT).