World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:10, No:08, 2016

# Modal Density Influence on Modal Complexity Quantification in Dynamic Systems

**Authors :** Fabrizio Iezzi, Claudio Valente

**Abstract :** The viscous damping in dynamic systems can be proportional or non-proportional. In the first case, the mode shapes are real whereas in the second case they are complex. From an engineering point of view, the complexity of the mode shapes is important in order to quantify the non-proportional damping. Different indices exist to provide estimates of the modal complexity. These indices are or not zero, depending whether the mode shapes are not or are complex. The modal density problem arises in the experimental identification when the dynamic systems have close modal frequencies. Depending on the entity of this closeness, the mode shapes can hold fictitious imaginary quantities that affect the values of the modal complexity indices. The results are the failing in the identification of the real or complex mode shapes and then of the proportional or non-proportional damping. The paper aims to show the influence of the modal density on the values of these indices in case of both proportional and non-proportional damping. Theoretical and pseudo-experimental solutions are compared to analyze the problem according to an appropriate mechanical system.

**Keywords :** complex mode shapes, dynamic systems identification, modal density, non-proportional damping
**Conference Title :** ICTAM 2016 : International Conference on Theoretical and Applied Mechanics
**Conference Location :** London, United Kingdom
**Conference Dates :** August 25-26, 2016