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Séminaire du LVA

Operational modal analysis in blind source separation framework

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Operational modal analysis (OMA) is an experimental modal analysis approach which aims at identifying the modal parameters of a structure based on vibration data collected when the structure is under its operating conditions. Due to the advantages of requiring no initial excitation or known artificial excitation, OMA can be utilized not only for structural design and control, but also for in-situ vibration-based structural health monitoring. Quite a few methods in OMA, mostly parametric, are developed and show success in certain applications. The drawbacks of these methods are their sensitivity to noise and their dependence on parametric mathematical model. Blind source separation (BSS) based methods have been shown to be efficient and powerful to perform operational modal analysis. Existing BSS modal identification methods, however, require the number of sensors at least equal to that of sources ($m \geq n$). In the present work, we propose a new frequency domain algorithm based on a joint diagonalization of a set of weighted covariance matrices. Thanks to the frequency domain essence of this algorithm, the following superiority comparing to the traditional BSS based methods are obtained. 1) The requirement $m \geq n$ can be easily obtained by selecting the frequency band; 2) The noise outside of selected frequency band have no influence on identification results; 3) Some classical spectrum estimating method can be utilized to reduce the influence of noise in selected frequency band. Numerical simulations and experimental example show that whether in determined or underdetermined situations, the proposed method performs accurate and robust identification of structure.