Blind Identification of Civil Structures

AUTHORS

Budhaditya Hazra, *Grad. Research Asst., Dept. of Civil and Env. Engrg., University of Waterlo*o
Sriram Narasimhan, *Asst. Professor, Dept. of Civil and Env. Engrg., University of Waterloo*
Mahesh Pandey, *Professor, Dept. of Civil and Env. Engrg., University of Waterloo*

ABSTRACT

This paper addresses the problem of output-only system identification using a new approach, known as Blind Source Separation (BSS). BSS involves extracting individual, but physically different sources from output measurements, where only a mixture of the sources is observed. BSS methods have shown promise in vibration analysis and output only system identification, where it is commonplace to deal with measurements resulting from mixtures of several excitation forces. Independent Component Analysis (ICA), an important tool to perform BSS, is a relatively recent method and has already found several applications in structural dynamics, including damage detection and condition monitoring. However, popularly used ICA algorithms face a number of difficulties in handling even moderate amounts of structural damping, as for example in civil engineering structures where the damping is typically of the order of 2-3% critical. These common difficulties are formidable enough to seriously hinder, if not defeat most of the ICA algorithms for structural system identification proposed thus far. In the present work we pose the blind identification as a traditional static mixtures problem, but propose a simple method to equip the current ICA algorithms to handle moderate amounts of structural damping. Additionally, we present an approach exploiting the time structure of responses, which can identify the modal parameters in structures subjected to forced excitations in addition to system identification in free vibration cases.