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THE ROBUST SMOOTH ORTHOGONAL DECOMPOSITION FOR SYSTEM IDENTIFICATION: A NEW WAY TO QUANTIFY THE MODAL PARAMETERS UNCERTAINTIES

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Abstract. Recently, the proper orthogonal decomposition (POD) has generated a family of methods that allow system identification using output-only data. They all have been developed to overcome some of the POD limitations in the field of linear modal analysis. Two important achievement was accomplish by the smooth orthogonal decomposition (SOD)(Bellizzi and Sampaio, 2015)(Chelidze andZhou, 2006)(Farooq and Feeny, 2008): first, the method eliminates the need of a priori knowledge of the inertia matrix to relate the proper orthogonal modes (POMs) to the linear normal modes (LNMs).Second, the method allows a direct estimation of the systemŠs natural frequencies.Although this powerful tool has provided good predictions, experimental tests have shown inconsistent results when significant noise levels are present in the signal. Compared with other operational modal analysis identification techniques, the so far proposed SOD has shown to be the one with more noise sensitivity(Brincker and Ventura, 2015). The reason can be shown through an analysis of the noise distortion in the correlation estimation of the measured data.In this article, two new robust versions of the SOD are presented. They solve the problem of the noise sensibility and also have new important features. The robust versions of the SOD allow the identification of the modal parameters and their uncertainties, that the SOD could not do (Wagner et al., 2017). Thanks to the method simplicity, efficiency implementations can be use to perform real-time identification (duringthe data acquisition phase). An application shows how the methods are used.