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PARAMETER ESTIMATION OF AN ELECTRO-MECHANICAL SYSTEM USING NARROW-BAND DATA

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Abstract. In this paper the problem of parameter estimate is investigated for an electro-mechanical system, in which the system response can only be measured over a narrow frequency range. So it is said to be estimation via narrow-band data. An estimate method is proposed, which consists of the lease square estimate, the grid searching, and the gradient algorithm sequently. The method has been applied to a test rig consisting of a mass-spring-damper, in which the mass M and spring stiffness K are known, but it is not possible to measure the damping parameter B. The system response could only be safely measured over a narrow range away from the resonant frequency because of the physical constraints of the system. Experimental results are presented to demonstrate the accuracy of the method.

Keywords. Parameter estimation, Least square estimate, Local grid searching, Gradient algorithm, Narrow-band data.
AMS subject classification: 93A30.

1 Introduction

In system identification, the steady-state response of a system to sinusoidal disturbances over a wide range of frequencies is analyzed to deduce the system dynamics. From this analysis a Bode diagram can be generated, which in turn is used to identify the system parameters [8]. However, in some cases a system response can only be measured over a narrow frequency range, providing only so called narrow-band data to identify the system parameters. Under this restriction it is likely that there is not enough data to accurately generate the Bode diagram for systems under study. In other words, the available frequency response data under such conditions doesn't cover the whole frequency range of the systems and hence the frequency response data cannot be used draw a full Bode diagram for the identification of the system parameters. Hence the Bode-diagram-based approach can not be used to