An Experimental Investigation of the Indirect Bridge Frequency Identification

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Abstract

Indirect identification of bridge frequencies, which refers to identifying bridge frequencies from the dynamic responses of a vehicle moving or stopping on the bridge, has the potential to fast inspect bridges in large quantities. Although there have been extensive studies on this topic, most of them are built on theoretic analysis or numerical simulation, which could differ from the situations in real practice. As a complement, this study carries out an experimental investigation of the indirect approach for bridge frequency identification. In the experiments, a normal passenger car instrumented with accelerometers moves and stops on a real bridge for indirect sensing, and a stationary accelerometer is directly deployed on the bridge as a control. Experimental results provide some new insights into the indirect bridge frequency identification from the practical aspect.

Keywords: indirect bridge frequency identification; vehicle-scanning method; drive-by sensing; power spectral density; signal-to-noise ratio; field test.

1 Introduction

Bridges are key traffic infrastructures that require regular inspections to ensure their operational and structural safety. Among the tasks of bridge inspections, one essential job is to identify the dynamic properties such as the natural frequencies of bridge structures [1]. Currently, one of the prevailing and familiar ways to identify the dynamic properties of in-service bridge structures is the fixed sensing framework. Tough the fixed sensing framework is pretty mature, it manifests some inherent demerits during the engineering practice. First and foremost, this framework is time- and labour-consuming because it needs to deploy a sensor network and a transmission system as a prerequisite [2]. Therefore, this framework is unable to satisfy the vast inspection demand for short- and medium-span bridges that are in large quantities.

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