Modal Identification Of Bridges Using A Single Moving Sensor

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Modal identification has always been a major tool in model updating, structural health monitoring and structural control. Traditional vibration tests aimed at measuring the modal parameters often require on-site installation of a vast array of sensors to guarantee higher spatial resolution of the identified mode shapes which leads to a costly process. Herein, the feasibility of using a single moving sensor for identifying the modal parameters of a bridge system is studied. The moving sensor output is first expressed, using Duhamel's integral, in terms of the modal parameters and the input excitation. The natural frequencies and damping ratios of the bridge are then obtained by using the Eigensystem Realization Algorithm. Following this, an algorithm is developed to identify the mode shapes of the bridge, while accounting for changes in flexural stiffness along the length of the bridge (indicative of damage). The proposed method is illustrated through a numerical study.