ENVIRONMENTAL EFFECTS ON IDENTIFIED PARAMETERS OF THE NEES SFSI TEST STRUCTURE

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In the past thirty years, many researchers have attempted to establish effective local and global methods for monitoring civil, aerospace and mechanical structures. The unpredictable nature of soil and the nonlinear behavior of civil structures, however, make monitoring rather complex. In fact, the combined soil/structure system is strongly influenced by environmental factors that can cause significant changes in system dynamics on a daily basis. Identification of structural damage in the presence of such fluctuations is difficult. This paper studies the changing dynamics of a simple test structure to quantify the random and semi-periodic changes in its behavior.

To better understand the correlation between environmental variations and the dynamics of soil-structure interaction, a semi-continuous monitoring of a test structure has been conducted. The analysis uses data from sensors located on several locations of the NEES Soil Foundation Structure Interaction (SFSI) test structure. The test structure is seated on very well-characterized soil in southern California with sensor arrays monitoring the soil response under the foundation. A network of sensors is designed and positioned to record temperature at various locations on the structure. Some soil properties, which are affected by temperature, rain and other environmental conditions, are also monitored. The test structure is equipped with a shaker under the ceiling to allow forced-vibration experiments as needed for identification.

This study uses the natural excitation technique in conjunction with the Eigensystem Realization Algorithm (ERA) for identification of modal parameters. As anticipated, measured environmental data and the identified parameters are shown to demonstrate strong correlation between variations in the environmental/soil features and in the dynamic properties of the structure. Recognizing and extracting such non-structural effects are considered to be quite promising to improve structural health monitoring and control; analyzing the patterns of this correlation is a topic of current and future investigation.

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