Structural identification of bridges: Monitoring, Maintenance and Repair

Cristian-Claudiu COMISU
Professor
The "Gheorghe Asachi"
Technical University
Iasi, Romania
comisucc@ce.tuiasi.ro

Gheorghita BOACA
Ph.D Student
The "Gheorghe Asachi"
Technical University
Iasi, Romania
boaca_gheorghita@yahoo.com

Summary

The use of system identification (SI) for deterioration modelling of damage and prediction of service life of large structures like bridges for environmentally constrained and urbanized areas, has received considerable attention in recent years. System identification can be described as the process of deducing or updating structural parameters based on dynamic input and output (I/O) measurements, or in some cases solely based on output measurements. The structural parameters of concern could be stiffness, damping or modal parameters. Based on the change of structural parameters, the condition of structure of bridge can be monitored.

Keywords: Bridges; structural health monitoring; damage detection; system identification; service life; maintenance; repair.

1. Introduction

National Roads Administration of countries throughout the world has the responsibility of maintaining the safe and efficient road networks that are important for a nation's economic development. A key element of any road network is the bridge infrastructure for environmentally constrained and urbanized areas. Also, bridge maintenance in urbanized areas is becoming an increasingly important issue in most developed countries. Limitations in the budgets available to Road Transport Authorities for bridge maintenance, rehabilitation, and reconstruction programs necessitate implementing comprehensive Bridge Management System that can accurately priorities this expenditure.

Damage or fault detection, as determined by changes in the dynamic properties or response of structures, is a subject that has received considerable attention in the literature. The basic idea is that modal parameters (notably frequencies, mode shapes, and modal damping) are functions of the physical properties of the structure (mass, damping, and stiffness). Therefore, changes in the physical properties will cause changes in the modal properties.

A system of classification for damage-identification methods, as presented by Rytter (1993), defines four levels of damage identification, as follows:

Level 1. Determination that damage process is present in the structure of bridge

Level 2. Determination of the geometric location of the damage process

Level 3. Quantification of the severity of the damage process

Level 4. Prediction of the remaining service life of the structure of bridges

For bridges in urbanized areas damage may be material or structural defect formed during the

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