



## Benchmark model updating for cable stayed bridges

Minghui Lai, Haiying Ma

*Tongji University, Shanghai, CHN*

Pingkuan Sun

*China Highway Engineering Consultants Group Corporation, Haikou, China*

Jose Turmo

*Universitat Politècnica de Catalunya BarcelonaTECH, Barcelona, Spain*

Contact: [mahaiying@tongji.edu.cn](mailto:mahaiying@tongji.edu.cn)

### Abstract

The use of benchmark model aims to establish a model with sufficient accuracy to reflect structure performance. Its purpose is seeking differences through repeated studying on problems using common FE model. In the paper, a novel approach is proposed for the benchmark model updating of a cable stayed bridge. It is based on the interaction of numerical analysis program and FE analysis program with updating model parameters from loop iteration operation. Shell elements and beam elements are both used, and the natural vibration frequencies and mode shapes from plate-shell element model are determined. These are used to modify the parameters used in a spine-beam element model, and to simplify a complicated FE model as a benchmark model. The genetic algorithm (GA) is introduced to complete the calculation process of loop iteration. Finally, an updated benchmark model is proposed for cable stayed bridges.

**Keywords:** program interaction; model updating; genetic algorithm; fitness function.

### 1 Introduction

During the whole life cycle of long-span bridges, the safety, applicability and durability need to be guaranteed. The traditional finite element method (FEM) is satisfactory in the experimental problems of numerical simulation, but it lacks timeliness and standard in assessing the health of the bridge. The Bridge Health Monitoring (BHM) Benchmark Model is the first concept proposed in the International Association of Bridge Maintenance and Safety, IABMAS 2004. The Benchmark FEM takes the validity of the test results as the starting point, and aims to establish a unified platform for evaluating

the efficiency of different health assessment methods through monitoring data.

Recently, researchers have carried out a series of structures health monitoring studies such as the monitoring method, the identification of modal uncertain parameters, model correction, damage identification, and vibration control based on the Benchmark model. Since the concept of the BHM Benchmark model was proposed, various bridge-type benchmark models have been established. Xia et al. (2013,2019,2020) proposed a new neutral axis indicator monitoring method for the concrete structures. Some researchers used SSI method to identify the mechanical parameters of cable