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# Bayesian model updating based on MCMC simulation algorithm

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## 【Background】

As a significant issue, monitoring bridges' structural safety and durability and ensuring their normal operations have attracted much attention. And the FE model is widely used for the prediction of responses and the improvement of the design. In combination with the monitoring measurement of the real structure, the FE model is able to provide much more detailed information about the state of the system. For these purposes, FE model of structure must be highly accurate. But a significant discrepancy may be found between the predicted dynamic properties from the FE analysis (FEA) and those measured directly from the structural vibration.

## 【Objective】

This study aims to minimize the error between the output data and the corresponding predictions of the FE model. the uncertainties in the values of the model parameters. Using the accurate models obtained by structural model updating method for damage detection and structural health monitoring is available.

## 【Approach】

By the field test, the natural frequency and mode shape of every mode can be measured with system identification. Markov chain Monte Carlo (MCMC) simulation is applied to update the structure based on identified dynamic properties from the field test data.

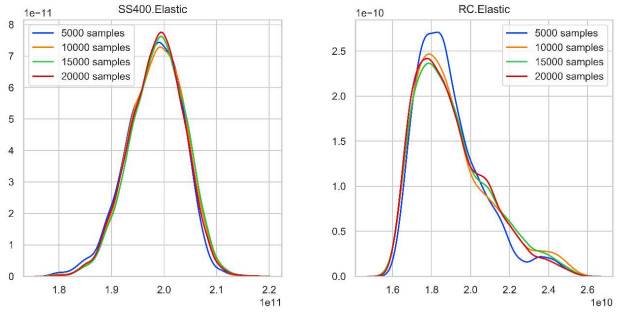
## 【Results】

After the updating progress, the uncertainties in the values of the model parameters is confirmed. And in the high probability regions, the error between the output data and the corresponding predictions of the FE model is smaller than initial model.

Updated modal frequencies

| | 1st mode | 2nd mode | 3rd mode | 4th mode | 5th mode |
|---|---|---|---|---|---|
| **Experiment** | 3.12 HZ | 4.93 HZ | 9.32 HZ | 11.04 HZ | 21.89 HZ |
| **Updated** | 3.09 HZ | 5.16 HZ | 9.27 HZ | 10.89 HZ | 21.23 HZ |
| **Error** | 0.962% | -4.665% | 0.536% | 1.359% | 3.015% |

Distribution of SS400.Elastic and RC.Elastic

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