Structural Performance Evaluation of Actual Bridges by means of Modal Parameter-based FE Model Updating

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【Background】

FE model updating methods have been widely investigated to improve the accuracy of the FEA based on experimental data. However, most existing studies focus on laboratory experiments and numerical simulations, and the actual structures are not fully investigated. Moreover, the feasibility of the FE model update for damage detection is yet unclear.

【Objective】

(1) Verify the applicability of the FE model updating on actual bridges.;
(2) Investigate the influence of model class in model updating;
(3) Investigate the feasibility of damage detection by the modal parameter-based FE model updating.

【Approach】

Using the modal identification method extracts the modal parameters from the experimental data. Based on the sensitivity analysis, several model classes are proposed. In the model class, multiple members are grouped into a block, and values of uncertain model parameters of the members in the same block are assumed to be equal to reduce the number of model parameters. Then, the model updating is conducted on these proposed model classes. By comparing the updated modal and model parameters, the capability of model updating is verified, and the feasibility of damage detection by model updating is discussed.

【Publication plan】

・One journal paper for the model updating in time domain.

【Results】

The modal parameters of the updated models all closely approximate those identified from experimental data. The updated distribution of the updated parameters shows a similar trend to that obtained by experimentation.

	Mode	1st bending	1st torsional	2nd bending	3rd bending	4th bending
DMG1	Freq. (Hz) (experiment)	2.98	5.21	6.87	9.61	10.57
	Freq. (Hz) (FE update)	3.20	4.93	6.80	10.11	10.60
	Difference of Freq (%)	7.49	-5.46	-1.03	5.18	0.30
	MAC	0.9971	0.9958	0.9953	0.9945	0.9814
RCV	Freq. (Hz) (experiment)	2.97	5.19	6.84	9.57	10.46
	Freq. (Hz) (FE update)	3.22	4.97	6.84	10.22	10.71
	Difference of Freq (%)	8.26	-4.16	0.05	6.74	2.36
	MAC	0.9986	0.9924	0.9876	0.9913	0.9824