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Enhancing Structural Damage Evaluation of PC Girder Bridges

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【Background】

PC bridges constitute roughly 45% of the total bridge stock of Japan, and a considerable number of PC girder bridges exhibit concerns like prestressing tendon corrosion, structural cracking, and excessive deflection. Concurrently, ongoing challenges arise in the form of a scarcity of human resources and escalating maintenance expenses. Consequently, the formulation of a unified analytical framework for evaluating the structural performance of deteriorated PC girder bridges holds significant value.

【Objective】

This study aims to enhance the evaluation of tendon damage in PC girder bridges by establishing a 3D high-fidelity finite element (FE) model and employing a seamless digital twinning Bayesian model updating framework. The physical digital twin model emphasizes endowing each component object with physical properties, ensuring that the model can authentically replicate the physical responses of the actual structure.
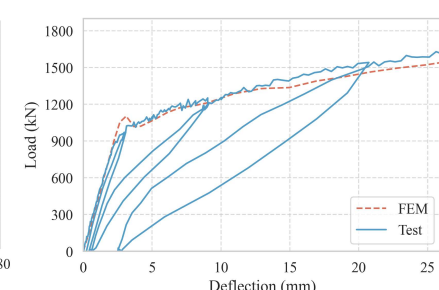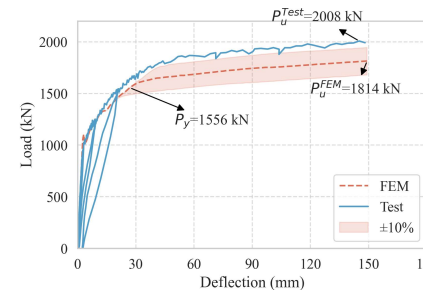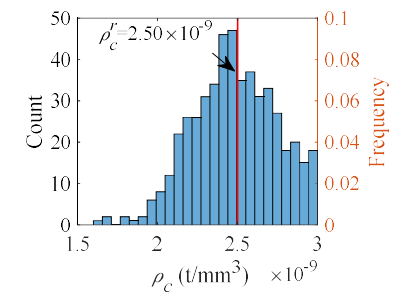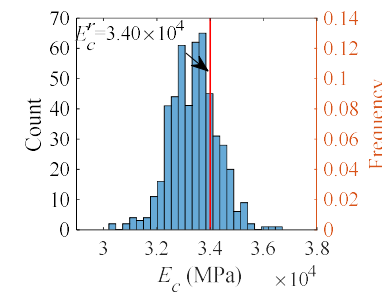
【Approach】

The data interface of DIANA is integrated with Python for secondary development, enabling the FE model to interact with test data and facilitating the construction of physical digital twin models. The most probable values (MPVs) of model parameters are utilized to calibrate the FE model. The selection of a plausible model class is informed by the estimated model evidence.

【Publication plan】

・A journal paper that summarizes the research findings of this study.
・R6 JSCE National Conference.

【Results】

The utilization of the 1st bending mode and elastic deflections in the model updating process has yielded accurate estimates of material parameters.

Comparison of measured and simulated load-deflection curves

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