

Damage Factor Estimation of Crane-Hook (A Database Approach with Image, Knowledge and Simulation)

**Takuma Nishimura¹⁾, Takao Muromaki¹⁾, Kazuyuki Hanahara¹⁾
Yukio Tada¹⁾, Shigeyuki Kuroda²⁾, and Tadahisa Fukui²⁾**

¹⁾Graduate School of Engineering, Kobe University, Kobe 657-8501, Japan.
Email: ni-takuma@opt.cs.kobe-u.ac.jp

²⁾Martec K.K., Kobe 650-0046, Japan.

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Abstract

One of the important aspects of engineering design is modification or improvement of the existing or preceding designs. It is natural for design engineers to perform such modification or improvement based on the information or knowledge obtained from the damaged products, especially in the case of the structural design. From this view point, estimation of damage factors based on actual damaged products is crucial for the design modification process. In our study, we deal with the damage factor estimation of crane-hooks that are attached to the excavators.

Our estimation approach utilizes the database constructed based on the images of the damaged crane-hooks, the FEM analysis results of the crane-hooks and a kind of knowledge obtained from the experienced engineers, in the following manner[1]. The images of the damaged crane-hooks are characterized as the displacement data obtained based on the comparison with a number of specific points of the corresponding undamaged crane-hooks. Taking advantage of the FEM analysis results, preliminary estimation of corresponding applied loads causing the damage are conducted by means of a Bayesian estimation manner[2]. The estimated loads are tailored by engineers' comments based on their own experiences.

The use of the obtained database to estimate the damage factor, that is the load condition causing the damage, is also performed in Bayesian fashion. An update process of the database is proposed so that it takes account of the newly estimated damage factors. The feasibility of the proposed approach is discussed based on the comments of the experienced engineers as well as some experimental results conducted.

References

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