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Multi-output Gaussian process surrogate model for structural reliability optimization. (Chinese. English summary) [Zbl 1463.74101]

Summary: The calculation cost of Reliability-Based Design Optimization is relatively expensive for structures with multiple failure modes. Therefore, this paper uses a Multi-Output Gaussian Process (MOGP) surrogate model to reduce the calculation cost. In this study, first of all, the Bucher’s method is used to generate initial samples, and then uniform training samples and a learning function are used to build the MOGP surrogate model. The learning function can obtain satisfactory training samples in a large range, which can ensure that the MOGP surrogate model has better global accuracy, so that there is no need for MOGP surrogate model to be rebuilt in the whole optimization process. The MOGP surrogate model can consider the correlation of each failure mode by using the covariance matrix, thus it has a good prediction for the multi-input and multi-output system. Numerical examples show that the proposed method has satisfactory results and high calculation efficiency, especially when the numbers of design variables and failure modes are large.

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