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结构的概率-非概率混合可靠性模型

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Probabilistic and Non-probabilistic Hybrid Reliability Model of Structures

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摘要 将影响结构可靠性分析的不确定性因素用概率和非概率两种方式模拟。并基于结构可靠性分析中的概率可靠性模型和非概率集合可靠性模型，提出一种新的结构可靠性分析的概率-非概率混合模型。该模型首先通过将功能函数进行非概率可靠性分析，然后将标准化区间变量空间所有区域的可靠度进行求和计算，从而给出结构的可靠度。并根据相同的不确定信息，由混合可靠性模型与概率可靠性模型得到的结果是相等的，证明了方法的有效性。最后，通过一个典型结构和一个机翼下壁加筋板与传统概率可靠性模型进行比较，表明该混合模型对于结构的分析和设计更为合理，能够更好地保证结构的安全性。

关键词： 不确定性　可靠性分析　概率可靠性模型　非概率集合可靠性模型　概率-非概率可靠性模型

Abstract： This article uses a combination of probabilistic and non-probabilistic methods to describe the uncertain factors that influence structural reliability analysis. Based on the probabilistic reliability model and non-probabilistic set-based reliability model, a new hybrid probabilistic and non probabilistic reliability model is proposed. First，the performance function is analyzed by the non-probabilistic set-based reliability model, and then the reliability of all regions in the normalized interval variable space is summed up. In this way, the reliability of a structure can be obtained. Based on the same uncertain information, the calculated results of the hybrid reliability model and the probabilistic reliability model are equivalent. The computation of the reliability of a classical structure and a wing stiffening plate are used to illustrate that the hybrid model is as effective as the traditional probabilistic reliability model. The results indicate that this hybrid model is more reasonable for the analysis and design of structures and can ensure their security.

Keywords： uncertainties　reliability analysis　probabilistic reliability model　non-probabilistic set-based reliability model　probabilistic and non-probabilistic hybrid reliability model

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