

学术论文

欠人工质量缩尺振动台试验结构模型设计方法

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摘要:

振动台试验是研究结构抗震性能的重要方法。以单跨六层钢筋混凝土框架结构为例, 对满足一致相似律的不同配重模型分别按构件等面积配筋率和按构件承载力相似原则进行配筋设计的缩尺模型与原型, 采用有限元软件SAP2000和MSC.MARC分别进行了Pushover分析和弹塑性时程分析。分析结果表明: 模型钢筋与原型钢筋性能相同(不完全满足相似关系)而模型混凝土性能满足相似关系要求时, 按构件等面积配筋率配筋的缩尺模型不能正确反映原型的地震响应, 高估原型的抗震能力; 按构件承载力相似原则进行配筋设计能够较好地解决这一问题; 当构件配筋率较高时, 配重不足因素的影响小。针对按构件承载力相似原则配筋设计的方法, 提出按模型钢筋弹性模量比修正杆件面积配筋率的改进建议。图8表11参18

关键词: 钢筋混凝土框架结构 欠人工质量 振动台试验 相似关系 缩尺 设计方法

Design method of small scaled shaking table test structural model lacking artificial mass

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Abstract:

Shaking table test is an important method to study dynamic performance of a structure under earthquake. With a bay 6-story prototype RC frame structure as an example, this paper presents design results of two series scaled models designed following the general similitude laws. One series scaled models were designed with element reinforcement ratio being constant while the other series models were designed following the similarity relation of element load carrying capacity. Pushover analysis and nonlinear dynamic analysis of these models under different artificial mass degrees were carried out by using software SAP2000 and MSC.MARC respectively. The analytical results indicate that if mechanical parameters of the model concrete satisfies the similitude requirement but mechanical properties of the model reinforcement are close to those of the prototype reinforcement, the seismic resisting capacity of the frame predicted based on the scaled model designed following element reinforcement ratio being constant can be significantly overestimated. While those following the similarity relation of element load carrying capacity work well. If the element's reinforcement ratio is high, influence of the lacking artificial mass degree on model response is not obvious. A new method on adjusting element reinforcement ratio based on Young's modulus ratio of model reinforcement bar is proposed.

Keywords: RC frame structure lacking artificial mass shaking table test similitude law scaled design method

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