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# 磁流变阻尼器优化设计及结构地震损伤控制

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# OPTIMAL DESIGN OF MR DAMPERS AND SEISMIC DAMAGE CONTROL OF STRUCTURES

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- 摘要
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摘要

该文通过LS-DYNA 程序二次开发了磁流变(MR)阻尼器的Bouc-Wen动力滞回模型、半主动控制律和钢材的弹塑性损伤本构模型,进而实现应用通用有限元程序精细化模拟受控结构损伤发展过程的目的.基于损伤本构模型,提出结构构件和结构层的抗震性能指标,并应用该指标对结构各层阻尼器的最大出力进行优化设计.对一9 层Benchmark 钢框架结构进行损伤控制研究,采用IDA 方法对控制前后结构的抗震性能进行分析,结果表明:MR 阻尼器优化设计后受控结构的损伤累积效应较无控结构明显减小,损伤分布范围更广,塑性耗能能力和抗震能力都得到显著提高.

关键词: 结构控制 地震损伤 磁流变(MR)阻尼器 半主动控制 抗震性能指标

Abstract:

The Bouc-Wen model of an MR damper, the semi-active control law, and an elastic-plastic material model considering damage variables are developed through the secondary development of LS-DYNA program, which makes the refinement damage evolution simulation of a semi-active controlled structure in general finite element program come true. Based on the damage material model, two seismic performance indices for member and story level are proposed and also used to determine the maximal control force produced by MR dampers on different stories. As a numerical example, the damage control study on a 9-story benchmark steel frame are conducted, and the aseismic performance of the structure both with and without MR dampers are analyzed through IDA method. The results indicate that: damage accumulation effects of a controlled structure are obviously reduced by using optimally designed MR dampers, the damage distribution is more widespread, and the capacity of absorbing earthquake energy as well as the aseismic performance are all increased significantly.

Key words: structural control seismic damage magnetorheological (MR) damper semi-active control seismic performance index

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