计算力学学报
Chinese Journal of Computational Mechanics

艾庆华,王东升,向敏.基于纤维单元的钢筋混凝土桥墩地震损伤评价[J].计算力学学报,2011,28(5):737~742

基于纤维单元的钢筋混凝土桥墩地震损伤评价

Seismic damage evaluation of RC bridge columns based on fiber elements

投稿时间： 2010-06-07 最后修改时间： 2010-10-04

DOI：10.7511/jslx201105015

中文关键词： 钢筋混凝土桥墩 基于性能抗震设计 纤维单元 损伤指标 低周反复加载试验

英文关键词:reinforced concrete bridge columns performance based seismic design fiber element damage index cyclic loading test

基金项目:国家自然科学基金(50878033,50978042);河北省自然科学基金青年基金(E2010001066)资助项目.

作者	单位	E-mail
艾庆华	石家庄铁道大学 桥梁工程教研室,石家庄 050043	wdszxb@dlut.edu.cn
王东升	大连海事大学 道路与桥梁研究所,大连 116026	
向敏	石家庄铁道大学 桥梁工程教研室,石家庄 050043	

中文摘要:

基于纤维模型的梁柱单元特别是柔度法单元有着较高的计算精度,已被较多地用于评价钢筋混凝土桥墩的位移(延性)能力。随着基于性能/位移抗震设计理论的发展,相继提出了残余位移、极限曲率及曲率延性系数、纵筋和混凝土的最大应变、纵筋低周疲劳损伤等桥墩地震损伤量化指标。选用刚度法和柔度法纤维单元,考虑材料非线性、几何非线性和结点锚固钢筋粘结滑移的影响,通过数值分析和试验数据对比研究了利用纤维单元对上述损伤指标进行估计的准确程度及主要影响因素。结果表明,柔度法单元计算的损伤参数均大于刚度法;两种纤维单元计算的滞回曲线及残余位移和试验结果十分接近,刚度法单元计算的截面曲率和纵筋拉应变更接近试验值,当加载位移幅值或剪跨比较大时,两种单元有时会低估桥墩的截面曲率反应;两种单元都会高估桥墩纵筋的最大拉应变,低估核芯混凝土的最大压应变。

英文摘要:

For the advantage of high computational accuracy, fiber beam-column elements are widely used in evaluation of displacement ductility capacity of RC bridge columns. With the development of bridge performance/displacement based seismic design, several damage indices have been suggested, such as ultimate curvature and curvature ductility factor of critical section, maximum strain of confined concrete and reinforced steels, low cycle fatigue damage indices of longitudinal reinforcement etc. To study the accuracy degree of damage indices calculated with fiber elements and the main influencing factors, stiffness-based and flexibility-based fiber elements are chosen to compute aforesaid damage indices compared with test data of RC bridge columns, with consideration of material non-linearity, geometrical non-linearity and bond-slip of anchoring steel. The study results show that the damage indices caculated by flexibility-based element are greater than those by stiffness-based element. Force-displacement curves and residual deformation calculated by both elements match the experiment with adequate accuracy. Section curvatures and tensile strain of longitudinal steel by stiffness element are colser to experimental data than those by flexibility element, but both elements underestimate section curvatures if loading displacement amplitude or shear span ratio is large. Both element overestimate tensile strain of longitudinal steel and underestimate compressive strain of concrete.

查看全文 查看/发表评论 下载PDF阅读器

关闭