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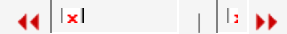
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## 地震空间变异性对车桥系统响应的影响分析

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### INFLUENCE OF SPATIAL VARIATION OF SEISMIC GROUND MOTION ON DYNAMIC RESPONSE OF TRAIN-BRIDGE SYSTEM

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#### 摘要

该文研究地震空间变异性对车桥动力相互作用的影响. 依据场地特征, 采用基于谱理论的无条件模拟方法产生非平稳的多点地震加速度时程; 使用临界阻尼振子形式的高通滤波器对其修正, 进而得到满足一致化要求的地震记录. 影响空间变异性的因素均能够在该地震记录中得到充分反映. 推导了绝对坐标系下考虑地震作用的车桥系统运动控制方程; 其中, 地震激励以位移时程形式作用到桥梁结构上. 最后, 选取8节车辆编组的高速列车通过3跨钢桁拱桥作为研究对象, 分别进行了在地震动行波激励以及完全空间变异性激励作用下的动力响应分析; 并将结果进行了对比. 数值分析结果表明: 车桥耦合动力分析中输入地震动需要考虑完全空间变异性的影响, 这才能保证所有分析车速范围内车辆响应结果偏于安全.

关键词: 地震地面运动 空间变异性 车桥系统 无条件模拟 行车安全

#### Abstract:

The influence of spatial variation of seismic ground motion on the dynamic response of a train-bridge system is studied. In term of the site characteristics, non-stationary acceleration time histories of multiple supports are generated by using an unconditional simulation algorithm based on the spectral representation. The high-passing filter in the form of a critically damped oscillator is used to obtain the consistent earthquake record including all factors of spatial variation. Then, the governing equations of motion of the train-bridge system during earthquakes are established in a absolute coordinate system, in which displacement time histories of a seismic excitation are exerted on the bridge supports. Finally, a high-speed train with eight vehicles running over a 3-span steel truss-arch bridge subjected to earthquakes is taken as a case study in the consideration of the wave passage effect and full spatial variation. Numerical results show that the full spatial variation of seismic ground motion should be considered in order to obtain the safe response of a train subsystem at all train speeds.

Key words: seismic ground motion spatial variation train-bridge system unconditional simulation running safety

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