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混凝土材料宏观力学特性分析的细观单元等效化模型

Meso-element equivalent model for macro-scopic mechanical properties analysis of concrete materials

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中文关键词： 混凝土 细观单元等效化模型 特征单元尺度 等效化 力学特性

英文关键词:concrete meso-element equivalent model characteristic element scale equivalence mechanical properties

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中文摘要:

提出了一种混凝土材料宏观力学特性分析的新方法—细观单元等效化模型。该方法从描述混凝土材料的细观尺度入手,采用Monte Carlo法生成由骨料颗粒及砂浆基质组成的试件的随机骨料模型;然后,依据混凝土材料特征单元尺度来剖分有限元网格并投影到建立的随机骨料模型上,各细观单元的有效力学特性则采用复合材料等效化方法来确定。本文方现了材料非线性宏观力学特性源于其内在的不均匀性这一认识,而对不均匀性的描述则是以网格剖分是否影响其宏观力学特性为准则。因此,本文方法较其他细观力学方法最大的优极大地减小了体系自由度数目(特别是对于三维问题),从而提高了计算效率。算例分析初步验证了本文方法的高效性。

英文摘要:

A new method,meso-element equivalent model,was proposed in the paper to analyze the macro mechanical properties of concrete materials.The method was described to start with the meso-scale of concrete; the Monte Carlo method was used to generate the random aggregate model of concrete composed of the aggre particles and the mortar matrix.And then,the finite element grid was meshed based on characteristic element scale of concrete materials,and the mesh grid wa projected onto the established random aggregate model.The mechanical properties of every element were determined by equivalence method of composite-material proposed approach reflected the recognition of the macro-scopic mechanical properties of material nonlinearity due to their inherent heterogeneity.While the mesh whether affecting the macroscopic mechanical properties of concrete,was taken as the criterion for the non-uniformity description.Hence,comparing with meso-mechanical method,the excellent advantages of the method was that the system reduced the number of degrees of freedom greatly,which improved the computational efficiency,especially for 3D problems.The examples analysis in the paper confirmed the high efficiency of this method.

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