

弹塑性地基中黏性与黏弹性人工边界条件有效性的验证

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摘要 对于局部人工边界条件中的黏性人工边界条件与黏弹性人工边界条件, 由于其具有易于实现、精度较好、稳定性较高的特点, 目前在时域有限元法中得到广泛的应用。然而, 目前所应用的黏性与黏弹性人工边界条件大多是基于弹性介质的条件下推导出来的, 故一般只用于弹性介质, 能否将其直接移植于弹塑性介质以及移植后会带来多大误差尚未得到理论或实践证明。运用理论分析与数值验算的方法, 从两方面论证把弹性介质中的黏性人工边界条件与黏弹性人工边界条件应用于弹塑性介质的可行性, 分析其带来的误差。分析结果表明, 在介质塑性区域发展不是很大的情况下, 把弹性介质中的黏性与黏弹性人工边界简单地移植于弹塑性介质中, 不会带来很大的误差, 仍可满足工程精度的要求。

关键词 [土力学](#); [黏弹性](#); [人工边界条件](#); [弹塑性](#); [有效性](#)

分类号

VALIDITY OF VISCOUS AND VISCOPLASTIC ARTIFICIAL BOUNDARY CONDITIONS FOR ELASTOPLASTIC FOUNDATION

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Abstract

Two local artificial boundary conditions—viscous artificial boundary condition and viscous-spring artificial boundary condition, are widely used for soil-structure dynamic interaction analysis in time domain finite element method for their good feasibility, fine precision and high numerical stability features. However, two local artificial boundary conditions mentioned above are derived in elastic media, so they are ordinarily used in elastic media. However, it is not verified either theoretically or practically that whether they can be transplanted to elastic-plastic media without any change; or if can, how much error will be induced compared with true condition. Based on the conclusion made by other scholars that the error induced by transplanting viscous artificial boundary condition and viscous-spring artificial boundary condition derived in elastic media to viscoelastic media without any change will not be large, and on the conclusions that elastic-plastic media can be treated as nonlinear equivalent viscoelastic media under some conditions, the verification and error analysis are performed with theoretical analysis and numerical examination. Analytical results show that if the plastic region of media is limited to some extent, the error induced by transplanting viscous artificial boundary condition and viscous-spring artificial boundary condition derived in elastic media to elastic-plastic media without any change will not be great, and they can be accepted within engineering precision.

Key words [soil mechanics](#); [viscoelasticity](#); [artificial boundary conditions](#); [elastoplasticity](#); [validity](#)

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