Chair of Structural Mechanics
TUM School of Engineering and Design
Technical University of Munich

Master's Thesis

Implementation of an infinite element for the analysis of an elastodynamic halfspace with the Wave Based Method

Motivation

The Wave Based Method (WBM) belongs to the family of indirect Trefftz methods and uses weighted wave functions to model boundary value problems. This modeling approach permits to use less degrees of freedom than for example a finite element approach, as the accuracy of the WBM depends less on the prevailing wave lengths. In order to apply the WBM to an elastodynamic halfspace, it is necessary to implement boundaries for the transmission of incoming wave fronts. The so-called infinite element is able to perform such a transmission. Originally, it has been developed for the hybrid Trefftz finite element method and uses analytical solutions to describe the far field of an elastodynamic halfspace.

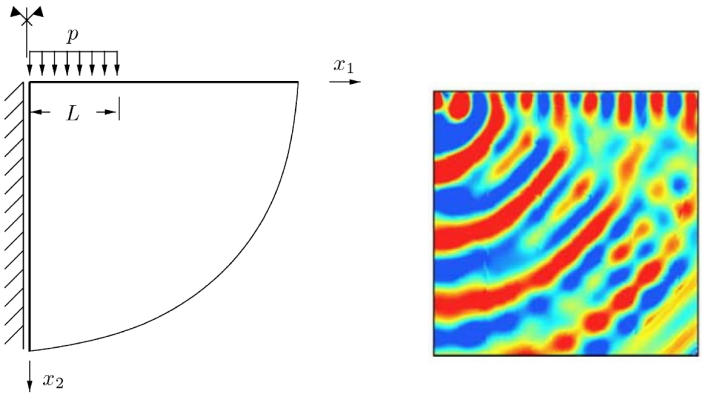

Fig. 1: Far field stress distribution within a halfspace (from: [2])

Tasks

In the scope of this master's thesis, a 2D infinite element for an elastodynamic halfspace shall be implemented into an already existing MATLAB code. For this, the already existing description for an infinite element in the case of a hybrid Trefftz finite element approach shall be transferred to the Wave Based Method. Moreover, the infinite element shall be assessed and compared to an already implemented absorbing boundary condition. The project stages are:

- Literature study about the Helmholtz equations and their decoupling procedure
- Literature study about the Wave Based Method and the infinite element
- Implementation of an infinite element
- Comparison of the results with an already implemented absorbing boundary condition
- Assessment of the two approaches

References

[1] de Freitas JAT (1997) Hybrid-Trefftz displacement and stress elements for elastodynamic analysis in the frequency domain. Computer Assisted Mechanics and Engineering Sciences 4:345-368.
[2] de Freitas JAT, Cismasiu C (2003) Hybrid-Trefftz displacement element for spectral analysis of bounded and unbounded media. Int J Solids Struct 40(3):671-699. https://doi.org/10.1016/S0020-7683(02)00615-7
[3] Desmet W (1998) A wave based prediction technique for coupled vibroacoustic analysis, PhD thesis 98D12. Katholieke Universiteit Leuven.
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