Wave Propagation Analysis by Spectral Stochastic BEM

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Ground has a complex structure and it is impossible to obtain the perfect information of the structure. Therefore, it is essential to take into consideration the effect of the uncertainty of the ground structure.

Here, as an efficient method to treat such uncertainty of the ground structure, Spectral Stochastic Boundary Element Method (SSBEM) is proposed and its efficiency is verified through numerical simulation. In SSBEM, geometric uncertainty of the boundary is expanded by Karhunen Loeve (KL) expansion and the solution is obtained as the best approximation in the space spanned by Polynomial Chaos (PC). Matrix of the SSBEM is obtained by Talyor expansion of the matrices of BEM, which should be calculated using Lagrange differentiation of fundamental solutions. It can be expected that accuracy is improved by adopting the higher order of Taylor expansion, although it requires more complex and large computation.

As a numerical example, wave propagation in 2D P-SV infinite field with circles whose geometry has uncertainty, is considered. The problem is solved by SSBEM and Monte Carlo Simulation (MCS), and their results are compared. It is found that SSBEM can give good approximation of the results of MCS, which indicates the applicability of the proposed SSBEM. It is also found, however, that matrices of SSBEM are quite ill-posed and further research is required to improve efficiency of computation of SSBEM.