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2D Numerical Modeling of the Ultrasonic Wave Propagation in Concrete: a Parameterization Study in the Multiple Scattering Medium

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Linear Ultrasonic Techniques play a major role in Non-Destructive Evaluation (NDE) for civil engineering structures in concrete since they can meet operational requirements. Interpretation of ultrasonic measurements could be improved by a better understanding of ultrasonic wave propagation in a multiple scattering medium.

In this work, we aim to get a 2D numerical model of ultrasonic wave propagating in concrete integrating the multiple scattering phenomena. This model will be used to realize some parametric studies of different parameters (wave frequency, aggregate size…) in order to interpreter the measurements or to optimize the measurement parameters before an auscultation

To get our numerical model, we use a step-by-step methodology based on the comparison between numerical results from SPECFEM software and experimental data and analytical approach available in the literature. First, this methodology was applied to one scattering element (cylinder) in a homogenous medium. Then, we model a multiple scattering media composed of a set of cylinders of random sizes and positions. Finally, we used numerical descriptions adapted to the case of industrial concrete that takes into account aggregates with a special size distribution in a mortar matrix.

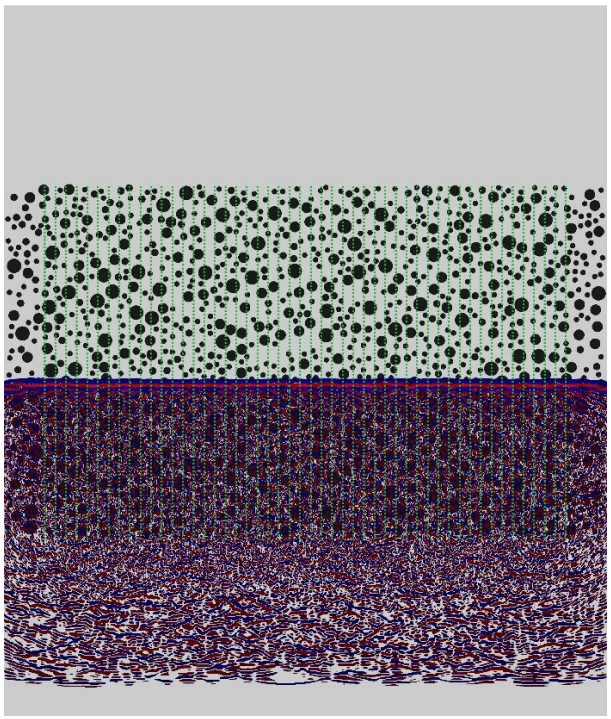

Figure 1. 2D numerical modeling in Specfem2D of the propagation of a Ricker plane longitudinal incident wave in concrete with a scattered concentration of 30%.