An inverse problem to develop CT for concrete structures

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For the time being, there exists no non-destructive inspection method for concrete structures which enables us to reconstruct thier interior structure, concretely and completely. In this talk, we shall discuss how to develop such a non-destructive inspection method for concrete structures, for which we shall apply ultrasonic waves. N. Mita and T. Takiguchi [MT] posed a problem for development of an ultrasonic CT method for concrete structures.

Problem *Let $\Omega \subset \mathbb{R}^3$ be a domain and $f(x)$, $(x \in \Omega)$ be the propagation speed of the sound. For $\alpha, \beta \in \partial\Omega$, we denote by $\gamma_{\alpha,\beta}$ a route from α to β through Ω. Reconstruct $f(x)$ $(x \in \Omega)$ out of the data*

$$\min_{\gamma_{\alpha,\beta}} \int_{\gamma_{\alpha,\beta}} 1/f(x) d\gamma, \tag{1}$$

for $\forall \alpha, \beta \in \partial\Omega$.

The main puroise in this talk is to study this problem in view of practical application for non-destructive inspection for expressway bridges. We shall also discuss some purely mathematical aspects of the above problem.

Some part of this talk is based on the joint research with Professor Noriyuki Mita (Polytechnic University of Japan).

Reference

[MT] *Basic propertiers of concrete and its non destructive testing,* MI Research 2, "Collaboration between theory and practice in inverse problems", 2015, pp. 117-137.