Multi-frequency EIT Method of Recovering Both Cracks and Reinforcing Bars in Concrete Structure

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ABSTRACT

Multi-frequency electrical impedance tomography (mfEIT) method is used to recover both cracks and reinforcing bars in concrete structures. With low frequency current below 1kHz, EIT method can identify outermost insulating cracks, whereas it is blind to reinforcing bars and cracks which are hidden by the outermost cracks. On the other hand, current at high frequency can penetrate thin cracks so that the reinforcing bars surrounded by outermost cracks are visible. We take advantage of this frequency dependant characteristics to identify both insulating cracks and reinforcing bars. Mathematically, based on the potential jump across the cracks at different frequencies, we give the asymptotic expansion formulas of the potential distribution at high and low frequencies. Thanks to these approximations, we are able to explain the structure of cracks including their thickness and endpoints. Numerical simulation results verify our mathematical theory.

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