

Frequency-Dependence on Electrical Impedance Tomography for Material Identification Embedded in Mortar

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Severe deterioration issues such as rebar corrosion and concrete cracking are paramount in reinforced concrete structures. Currently, prevailing deterioration detection methods rely on visual inspections, which impose substantial time and labor requirements. Moreover, techniques involving ultrasonic waves or X-rays demand specialized personnel, raising economic and safety concerns. As a solution, this study centers on electrical impedance tomography (EIT), a nondestructive imaging technology that presents a cost-effective and user-friendly approach to deterioration detection. EIT involves the placement of multiple electrodes on an object, applying alternating current, and measuring potential differences to visualize internal structures. Ikuno has developed an EIT device, and our group validated its suitability for cementitious materials. EIT visualizes conductors and insulators embedded within cement paste specimens as conductivity distribution. Nonetheless, EIT suffers from limited spatial resolution due to the diffusivity of currents, which is a probe within the object, occasionally resulting in image reconstruction errors. Because the complex impedance varies according to the diverse composition of building materials, this study aimed to discern the mortar and embedded materials by altering the measurement frequencies. Frequency-dependent EIT measurements are conducted on a cylindrical mortar specimen with an approximate diameter of 100 mm and an embedded metal rod with a diameter of 30 mm. The measured potential pattern generates an impedance distribution image using EIDORS, an open-source software designed for image reconstruction. When the measurement frequency is 50 Hz, the circular shape of the metal rod becomes discernible in the image. When the measurement frequency is 30 kHz, an asymmetric shape spreading around the metal rod, which is not present, is observed in the reconstructed image. On the scheduled day, a detailed discussion will be conducted regarding the correlation between each measurement frequency of EIT and material visualization.