

# **Application of GPR images to detect deformed shape of reinforcing bars in concrete**

**Taemin Lee<sup>1</sup>, Hajin Choi<sup>2</sup>**

<sup>1</sup>Department of Architecture Engineering, Soongsil University, Republic of Korea, <sup>1</sup>School of Architecture, Soongsil University, Republic of Korea

In this study, GPR (Ground Penetrating Radar) was used to analyze the deformation of reinforcing bars in concrete. GPR is a non-destructive device based on electromagnetic waves, which has a great advantage of non-contact data acquisition. However, vertical resolution is limited to evaluate deformed shape of rebars due to large wavelength of electromagnetic waves in concrete. To improve vertical resolution of GPR, signal and imaging algorithm is suggested in this study. First, wavelet transform was applied to extract high frequency components among the obtained signals. Second, migration-based imaging processing was developed to identify the shape of reinforcing bars. To be specific Time Gain control, Background Removal, Migration, and Hilbert Transform were modified to capture the shape deformation of rebars. For experimental validation, concrete specimens were produced, with different sizes of reinforcing bars (D10, D16, and D22). Signal data was acquired from each specimen under loading, and the shapes of the rebars was monitored. It was confirmed that the amplitude of the signal measured by the GPR device decreases as the size of the reinforcing bar decreases and that the Migration images show the differences. The developed signal and imaging processing show a great potential of the detection of reinforcing bars in concrete structures.