Classification of Ultrasonic Signals by Primary Water Stress Corrosion Cracking from Dissimilar Metal Welds Based on Deep Neural Network

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In nuclear power plant, major course of failure in DMW (Dissimilar Metal Welds) is PWSCC (Primary Water Stress Corrosion Cracking). Because in fatigue condition, PWSCC occurs at less stress than designed to endure, it grows faster and is easier to damage the DMW than other defects. Therefore, it is very important to distinguish PWSCC from other defects. However, the shape of PWSCC is similar with other cracking defects, it is not easy to classify the PWSCC through ultrasonic signals. Since the efficiency of DNN (Deep Neural Network) for classification of defects on welds is already proved, it is expected that the DNN can be used to classify PWSCC from other defects. In the previous study, a database of total 540 ultrasonic defect signals for three types of cracking defects (Crack, Lack of Fusion, Lack of Penetration) that occur in welds is constructed. By adding PWSCC data obtained through FEM simulation to this database, ultrasonic welds defects database including PWSCC signals with various testing conditions can be obtained. Using this database, the DNN can be trained to distinguish PWSCC from general cracking defects of welds. This result is expected to be a steppingstone to improve reliability of ultrasonic inspection at DMW in nuclear power plant by classify severe defects through DNN.