Fatigue crack detection in orthotropic steel deck bridges applied by FMC/TFM using reflected waves of multiple paths (1)

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We introduce the latest developed FMC/TFM (Full Matrix Capture and Total Focusing Method) and its application for fatigue crack detection in orthotropic steel deck bridge. This developed inspection system consists of the advanced high-speed ultrasonic inspection equipment and the remotely operated four-wheel scanner with a 32-channel ultrasonic array probe for angle beam inspection. We developed MP-FMC/TFM (Multiple Paths Phased-array FMC/TFM) in this project. MP-FMC/TFM enables to visualize outline image of cracks clearly by image synthesis based on the propagation route information of direct path and the other paths reflected on the bottom of an inspection object against clacks. This developed inspection system enables to generate clear B-scope images of deck plate crack and bead (in deck-to-rib weld) crack with high-resolution. Furthermore, it enables to synthesizes 3D images of crack propagation with high-resolution along the weld line in real time by integrating the B-scope images every time the scanner moves 2mm. As a result of verification test of fatigue crack propagation test specimens, it was confirmed that this inspection system enables to visualize crack shape clearly and to achieves measurement accuracy of ±0.8mm for depth of deck plate crack, and ±1.0mm for depth of bead crack. Currently, verification tests are being conducted on an actual bridge, and practical application is planned in near future.