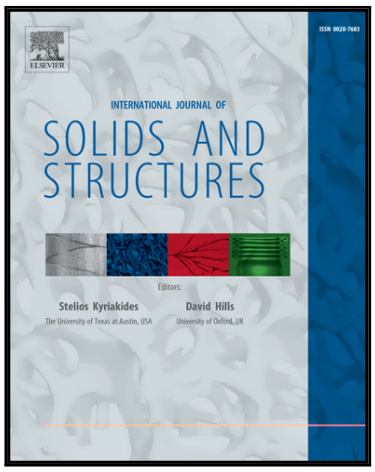

Multi-physical field guided wave simulation for circular concrete-filled steel tubes coupled with piezoelectric patches considering debonding defects

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Multi-physical field guided wave simulation for circular concrete-filled steel tubes coupled with piezoelectric patches considering debonding defects

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Abstract: The active interface debonding detection for concrete-filled steel tubes (CFSTs) using Piezoelectric Lead Zirconate Titanate (PZT) patches has been proposed and experimentally studied in recent years. In order to further investigate the guided wave propagation and the response of embedded PZT sensor, transient dynamic analysis on multi-physical field coupling models composed of surface-mounted PZT actuator, embedded PZT sensor and a circular CFST specimen considering the coupling effect between the PZT patches and CFST member and the influence of interface debonding defects is carried out numerically. The guided wave propagation within the CFST-PZT coupling system without and with interfacial debonding defects under single period impulse signal is simulated and compared. The voltage response time history of the embedded PZT sensor in coupling models under both sinusoidal and sweep frequency sinusoidal excitations are simulated as an alternative solver. Numerical results demonstrate that interface debonding leads to changes in guided wave propagation path, traveling time and the PZT sensor response. The sensitivity of a quantitative evaluation index called as the normalized wavelet packet energy of the output voltage of embedded PZT sensor to the initiation of interface debonding defect and its length and depth is illustrated.