Verification of Source Localization by Artificial Impact Sources in the In-service Buried Pipeline

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Recent increases in buried pipeline failures due to third-party interference have significantly heightened attention towards buried pipeline monitoring. These failures not only cause safety issues like gas explosions, environmental pollution, and ground settlement, but also disrupt vital resource supplies, potentially leading to urban paralysis. Hence, it is extremely important to localize such damages at an early stage to prevent failures in the buried pipeline system. There are several reports of pipeline monitoring via accelerometer, particularly, fluid-structure coupled vibration has gained attention for monitoring certain damages owing to its long-range propagation characteristics. In this study, source localization for artificially induced damage was performed on an in-service buried pipeline. Additionally, accelerometers were installed on various buried pipelines, each with a length of approximately 500 meters and diameters ranging from 900 to 1,200 mm, to conduct verification of source localization. We obtained the frequency response characteristics using artificial sources and determined the optimal frequency bands for accurate source location by observing spectral density and coherence, thus identifying the most suitable frequency bands for source location. As a result, we confirmed that the frequency range up to 200 Hz was suitable for source location using fluid-structure coupled vibration. Consequently, our study yielded an empirical source location in the tested pipeline that was in good agreement with the damage position.