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Application of deconvolution interferometry to extract quality factor of high-rise buildings

WU, Hao[1*] ; MASAKI, Kazuaki[2] ; IRIKURA, Kojiro[1]

[1]Disaster Prevention Research Center, Aichi Institute of Technology, [2]Department of Urban Environment, Aichi Institute of Technology

Deconvolution interferometry has been proved an effective method over cross correlation interferometry and coherence interferometry to monitor the health of buildings, extracting the shear velocity and quality factor from earthquake ground motion data or microtremor data (Snieder and Safak, BSSA, Vol. 96 (2), 2006; Nakata et al., BSSA, Vol.103 (3), 2013); Nakata and Snieder, BSSA, Vol. 104(1), 2014). Wang et al. (JAEE, Vol. 13(2), 2013) extended this method to monitor a multi-story damaged building in stricken city with microtremor by extracting the story-by-story shear velocity propagated inside the building during the 2011 Tohoku earthquake. However, the application of this method to estimating the quality factor of the buildings has not been fully investigated.

In this study, we focus on extracting the quality factor of shear waves from deconvolved waves with reference record on the ground floor. We conducted the microtremor measurement simultaneously in five floors for an hour by employing five sets of velocity seismometers with an 800 Hz record logger in several high-rise buildings being over 20 stories. The measurement is accomplished by moving four sets of equipment sequentially with one set fixed at the reference floor. The extracted quality factors of the buildings are expected to provide a reference for damping factor in the analysis of structural response.

Keywords: Deconvolution interferometry, quality factor, microtremor, high-rise buildings