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A THIRD-GENERATION OPTICAL FIBRE TRANSDUCER FOR LANDSLIDE MONITORING

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Abstract

Monitoring an unstable slope is quite important for environmental safety. Based on our previous studies, this paper presents a third-generation distributed optical fibre transducer. The operating mechanism of this novel transducer was analysed for its response to a single concentrated and uniform load, and a theoretical study was conducted on the elongation of the bottom-surface fibres of a bending resistance model at the phases of linear elasticity and total cross-section cut-off stage. A bending resistance test was conducted when this transducer was grouted with concrete C40 and two types of base materials - expanded polystyrene (EPS) and polyvinyl chloride (PVC). Experimental and theoretical studies results indicate that the minimum diameter of the second coiling of a single mode fibre is more than 20 cm at wavelength 1310 nm. The ratio of the measured value to theoretical value for elongation of optical fibres on the bottom surface is greater than 0.9, indicating significant correlation. The transducer with EPS as its base material provides a better response than the one with PVC, because of its higher initial measurement precision, larger sliding distance, and greater dynamic range. However, sliding is bound to produce shear force; therefore, further research on the performance of the transducer and its grout under shearing loads should be conducted.

Key words: monitoring, optical time domain reflectometry (OTDR), slope stability, third-generation distributed transducer

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