Development of a new blasting vibroseis technique and its application to the exploration of geological structures

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Abstrak

Seismic waves used for exploration of geological structures are mostly generated from blast sources. A new blasting vibroseis apparatus, which utilizes the homogeneity, isotropy, and incompressibility of water to reduce damage to adjacent rock from blast waves, was developed. This method overcomes the low repeatability and low control issues of traditional blast methods (downhole charge) while maintaining the advantages of high explosive power, sharp pulse signal, and a wide range of frequency domains. Blasting vibroseis and traditional blasting tests were implemented in the Three Gorges Reservoir Region, China. The finite element method (FEM) method was used to numerically calculate blasting vibroseis-induced dynamic ground pressures. Through a series of comparison tests, the characteristics of the seismic waves generated by blasting vibroseis were summarized and the repeatability and controllability of the blasting vibroseis test was validated. The blasting vibroseis apparatus was then used to detect geological structures below the surface of the Maoping landslide, China, and the results were very consistent with previous drilling exploration (89%), which reflects the practical value of the new blasting vibroseis for the exploration of geological structures. Blasting vibroseis can be used as a practical and cost-effective method to detect geological structures.