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Dynamic stress concentration around the circular tunnel under a transient Incident cylindrical P-wave

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Abstract: In mining engineering, dynamic stress concentrations around cavities generated by wave sources widely exist. To obtain the influence of wave curvature on the dynamic response around the circular cavity, the dynamic stress concentration near the cavity caused by a cylindrical P-wave scattering was investigated based on the wave function expansion methods and Fourier transform. A three-dimensional numerical finite element model was subsequently established to simulate the dynamic damage and its influencing factors, including the peak rising time of the incident wave and the initial lateral pressure coefficient, around the underground cavity subjected to cylindrical P-wave. The results indicate that an obvious dynamic stress concentration occurs around the cavity under dynamic stress disturbance. The dynamic stress concentration factors (DSCFs) caused by the cylindrical P-wave was obtained. Furthermore, the failure characters of the cavity under different initial static stresses and dynamic incident loadings are simulated using the software LS-DYNA, indicating that the dynamic failures are related to the initial static pressure coefficients, peak rise time (t0) of incident wave, and incident wavefront curvature.
Keywords: tunnel; transient loading; DSCF; wave function