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Numerical study on fracture patterns and crack growth on concrete under impact loading

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Concrete is used as protection at wide variety of applications because of its high compressive strength and easy-working. Initiation and growth of the cracks subjected to the impact loading causes failure in concrete. In this study, concrete specimens are simulated by a robust numerical method (Smoothed Particle Hydrodynamics) within the AUTODYNE explicit dynamic code. Numerical simulation and experiments on cylindrical concrete specimens has been done in order to predict and calculate the spacing primary crack pattern under dynamic impact loading. Quantitative validation of the numerical model was implemented and the results showed a good agreement between numerical simulation and the experimental data. Then, numerical simulation on cubic concrete specimens has been done as the same and results show that beside of high capability of numerical model to estimate the crack growth pattern; concrete specimens have better behaviour under impact in 45-degree with respect to horizontal rather than other positions.

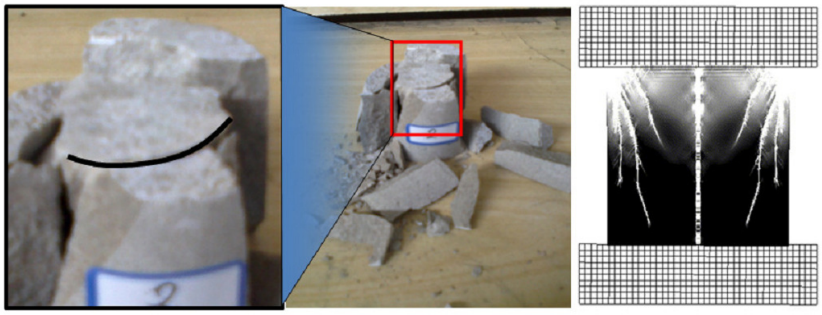

Figure 1: Good agreement between experimental and numerical simulation

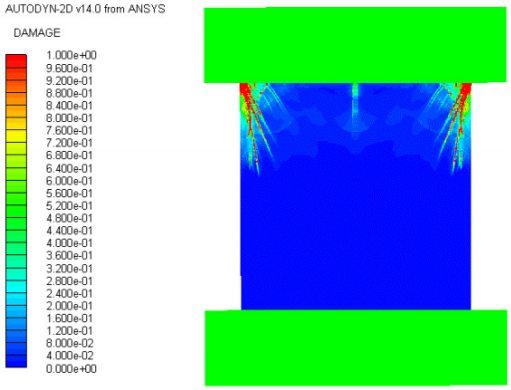

Figure 2: Damage contour in concrete under load

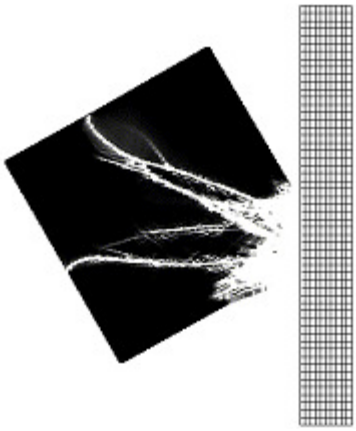

Figure 3: 45-degree impact