SIMULATION OF CAVITY EXPANSION EXPERIMENTS: SPHERICAL EXPLOSIVE CHARGES IN CONCRETE

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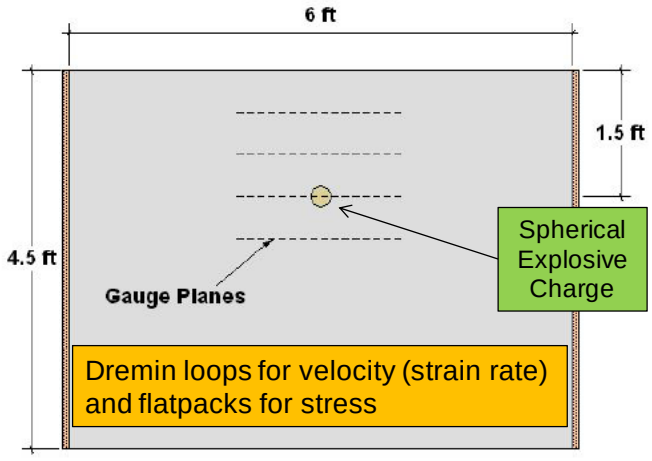
Gran et al. (2009) performed three spherical cavity expansion experiments using 1 lbf (0.45 kg) of Composition B explosive embedded in a 6 ksi (41 MPa) unconfined compressive strength concrete cylinder of diameter 6 feet (1.83 meters) with heights of 4.5 & 6 feet (1.37 & 1.83 meters). Dynamic measurements were made of the radial stress and radial velocity at various ranges from the explosive charge. The purpose of the experiments was to provide data to be used by so called "cavity expansion" forms used in penetration and cratering models.

Of present interest are the radial stress and velocity measurements made at the equator of the explosive charges, for which all three tests are identical. The radial velocity measurements are used to approximate the radial and circumferential strain histories. These strain histories provide estimates of the strain rates, which are shown to exceed 10^3 per second, significantly larger than other commonly referenced strain data for concrete.

Simulations were performed of the explosive cavity expansion experiments using two simple input concrete models available in LS-DYNA. The purpose of the simulations were to:

1. Assess the how differences in the shear failure and pressure-volume response of two concrete models affect the stress and velocity predictions.
2. Compare the model predictions with the measured radial stress and velocity.
3. Examine the strain rate effects predicted by one of the two simple input concrete models.



Gran, J.K., J.Q. Ehrgott, and J.D. Cargile, "Cavity Expansion with Spherical Explosive Charges in Concrete," US Army Engineering Research and Development Center (ERDC) , Report ERDC/GSL SR-09-4, September 2009.