Estimating detonation velocity for near-critical charge diameters

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The study suggests a system of equations connecting state and motion variables for a reaction flow at a sonic surface and a spherically shaped detonation wave shock front in a cylindrical charge of a near-critical diameter. Using simplifying assumptions, we obtained a dimensionless equation for the non-ideal detonation velocity as a function of charge diameter. The boundary inside which a solution to this equation exists determines critical conditions for steady detonation propagation. We defined a dimensionless group greatly affecting the non-ideal detonation velocity, along with its parameters determining the critical detonation diameter depending on extra explosive material characteristics. This group is the ratio of the energy removal timescale to the energy release timescale.

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