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Impact Ignition Design under Axi-symmetric Illumination System

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In impact ignition scheme, a portion of the fuel (the impactor) is accelerated to a super-high velocity beyond 108 cm/s, compressed by spherical convergence, and collided with a precompressed main fuel. The collision generates strong shock waves in both the impactor and the main fuel. Since the density of the impactor is generally much lower than that of the main fuel, the pressure balance ensures that the shock-heated temperature of the impactor is significantly higher than that of the main fuel. By this collision, the kinetic energy of the impactor is directly converted to the thermal energy corresponding to temperatures beyond 5 keV, which is required for ignition. Thus the impactor itself becomes an igniting hot spot under isobaric configuration.
The implosion symmetry is one of the crucial issues, and here we propose the optimization of polar drive illumination system for impact ignition, in which both direct and indirect schemes are considered. The beams are divided into two groups, one for the impactor and the other for the main fuel. The beams are irradiated in off-axis configuration with temporal evolution taken into account.
We also present a new type of compression of fuel in the use of hyper-spherical shock compression, in which owing to the enhanced geometrical accumulation, the shock-compressed densities and pressures turn out to be substantially higher than ones achieved by spherical shocks. Detailed linear stability analysis limited to spherical geometry reveals a new dispersion relation with cut-off mode numbers as a function of specific heats ratio, over which eigenmode perturbations are smeared out in the converging phase.

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