Contribution ID: **4** Type: **not specified**

Hydrodynamic attenuation of shock waves and entropy shaping

Friday, 23 June 2017 10:30 (20 minutes)

A model for the hydrodynamic attenuation (growth and decay) of planar shocks is presented. The model is based on the approximate integration of the fluid conservation equations, and it does not require the heuristic assumptions used in some previous works [1]. A key issue of the model is that the boundary condition on the piston surface is given by the retarded pressure, which takes into account the transit time of the sound waves between the piston and any position at the bulk of the shocked fluid. The model yields the shock pressure evolution for any given pressure pulse on the piston, as well as the evolution of the trajectories, velocities, and accelerations on the shock and piston surfaces. An asymptotic analytical solution is also found for the decay of the shock wave.

The model is also suitable for calculating the entropy shaping induced by a shock of decaying intensity. It is also shown that by allowing a causal connection between the shock and the piston, the model results to be complementary to the well-known self-similar solution for the impulsive loading problem, which is valid in the asymptotic regime when both fronts become decoupled [2]. As a consequence, the entropy distribution depends on the details of the driving pressure pulse. Comparisons with the available numerical simulations are presented [3-6].

References

[1] G. I. Taylor, in The Scientific Papers of Sir Geoffrey Ingram Taylor Collected Works, edited by G. K. Batchelor (Cambridge University Press, Cambridge, 1963), Vol. 3.

[2] Ya. B. Zeldovich and Yu. P. Raizer, Physics of Schock Waves and High Temperature Hydrodynamic Phenomena (Dover Publications, Inc., NY, 2002).

[3] F. Cottet and J. P. Romain, Phys. Rev. A 25, 576 (1982).

[4] A. Loeb and S. Eliezer, Phys. Fluids 28, 1196 (1985).

[5] R. J. Trainor and Y. T. Lee, Phys. Fluids 25, 1898 (1982).

[6] V. N. Goncharov, J. P. Knauer, P. W. McKenty, P. B. Radha, T. C. Sangster, S. Skupsky, R. Betti, R. L. McCrory, and D. D. Meyerhofer, Phys. Plasmas 10, 1906 (2003).

Primary author: Prof. PIRIZ, Antonio Roberto (Universidad de Castilla-La Mancha)

Co-authors: Dr TAHIR, Naeem Ahmad (GSI, Darmstadt); Dr SUN, YuanBo (Peking University)

Presenter: Prof. PIRIZ, Antonio Roberto (Universidad de Castilla-La Mancha)

Session Classification: Nanosecond plasma