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Shock wave structure for a polyatomic gas with large bulk viscosity

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Abstract

The structure of a standing plane shock wave in a polyatomic gas is investigated on the basis of kinetic theory, with special interest in gases with large bulk viscosities, such as the CO2 gas. The polyatomic version of the ellipsoidal statistical model is employed, and the shock structure is obtained numerically for different upstream Mach numbers and for different (large) values of the ratio of the bulk viscosity to the shear viscosity. The double-layer structure consisting of a thin upstream layer with a steep change and a much thicker downstream layer with a mild change is obtained. An analytical solution, consisting of a jump condition and a slowly varying solution, that can approximate the double-layer structure well is also presented. This work is a collaboration with Shingo Kosuge (Kyoto University).