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A Formulation of Compressing Process and Aeroacoustics JIE-ZHI WU[1], FENG MAO, LIJUN XUAN, WEIDONG SU, YIPENG SHI, Peking University, Beijing, China — We study the general theoretical formulation of compressing (longitudinal) process and aeroacoustics. A maximum Helmholtz decomposition (MaxHD) principle is proposed as the basic criterion of the formulation, which is applied at two levels. At the fundamental level, the MaxHD leads to a convective wave equation for dilatation as the counterpart of the diffusion equation for vorticity in the shearing (transverse) process. This is the fundamental governing equation for the compressing, equivalent to, among others, Lilley's (1973) 3rd-order equation for logarithmic pressure and, for inviscid flow, Howe's (1975) total-enthalpy equation. Phillips' (1960) 2nd-order equation is disqualified by MaxHD. At the operational level, the MaxHD further isolates the compressing variables from the others by decomposing the velocity itself. This yields a 4th-order convective wave equation for the velocity potential. Unlike equations of Lilley, Howe, and other equivalents, the source terms do not contain compressible velocity potential, and the vortical velocity appears only in source terms and operator coefficients. Thus, its linearized version should be the rational basis for problems of sound wave in various shear flows.

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