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The Enhancement of Streamwise Minus Modes during Evolution of a Subsonic Compressible Jet Flow HO-SHUENN HUANG — Direct numerical simulations in compressible jet flows within confined walls are studied. The results, excited by the random-broadband white noise in a sense of a natural experiment, will be further discussed in terms of jet instabilities from the beginning of noise level to the linear regime and transition to turbulence. An experimental study made of transition of a two-dimensional jet by Sato (1960) was chosen to run a similar direct numerical simulation in a temporal case and compared the results accordingly. Results of direct numerical simulations show a good agreement with experiment made by Sato in terms of linear growth rate and its eigenfunctions as well. In general the dominant spanwise modes (primary modes), usually the anti-symmetric modes, grow exponentially in the linear regime and saturated after the nonlinear interactions. However, there are streamwise minus modes developing, in the transitional to fully nonlinear regime, at rather bigger growth rates than the dominant spanwise modes. By examining the modal eigenfunction of the root-mean-square fluctuating velocity in downstream direction, the dominant spanwise mode behaves an anti-symmetric eigenfunction as measured by Sato's experiment. Interesting is it that the evolution of streamwise minus modes has a similarity to the symmetric eigenfunction as they develop into saturation.

Ho-Shuenn Huang

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