Computational Study of Supersonic Air Intake Buzz under Various Mass Flow Conditions

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ABSTRACT

The present study explores the flow instability around supersonic inlet, called inlet buzz. A set of computations are conducted under varying mass flow rate condition in order to investigate hysteretic character of inlet buzz. The mass flow rate is controlled by moving an exit throttling plug back or forth to change exit area.

An inlet with decreasing mass flow rate is simulated firstly. In this process, inlet buzz characteristic changes from the first mode of a low frequency regime to the second mode of a high frequency regime. Secondly, the effect of the increasing mass flow rate on inlet buzz is examined. This case shows another kind of the unreported buzz transition that the buzz frequency becomes higher in the third mode. The newly found hysteretic inlet buzz shares many similarities with the fundamentals of a pipe-type musical instrument, such as a self-excited feed-back mechanism and overblowing. Considering the similarities, the hysteretic characteristics of inlet buzz is explained from the instrumental acoustic point of view.

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