Design Exploration of Low-Boom and Low-Drag Configuration for Supersonic Business Jet

Shigeru Obayashi,
Koma Sato, Takayasu Kumano, Masahito Yonezawa, Hiroshi Yamashita and Shinkyu Jeong
Institute of Fluid Science
Tohoku University
Katahira 2-1-1, Aoba-ku, Sendai 980-8577, Japan
E-mail: obayashi@ifs.tohoku.ac.jp

ABSTRACT

Multi-Objective Optimization have been applied to a design problem of the twin engine concept for Supersonic Business Jet. This problem aims to find main wing, body, tail wing and engine nacelle configurations, which can minimize both sonic boom and drag in a supersonic cruising flight. The multi-objective genetic algorithm (MOGA) and the Kriging model has been used to search for globally optimal design candidates in the multi-objective problem, as well as reduce function evaluation time. The sonic boom and drag have been evaluated by using the waveform parameter method, coupled with the computational fluid dynamics (CFD) simulation. As a result, the present optimization can successfully obtain lowest-boom and lowest-drag design candidates, which are better than the baseline design by more than 40 %. Moreover, general information about the design space can be interpreted through visual data-mining using the self-organizing maps (SOMs) applied to all the searching points during the optimization.

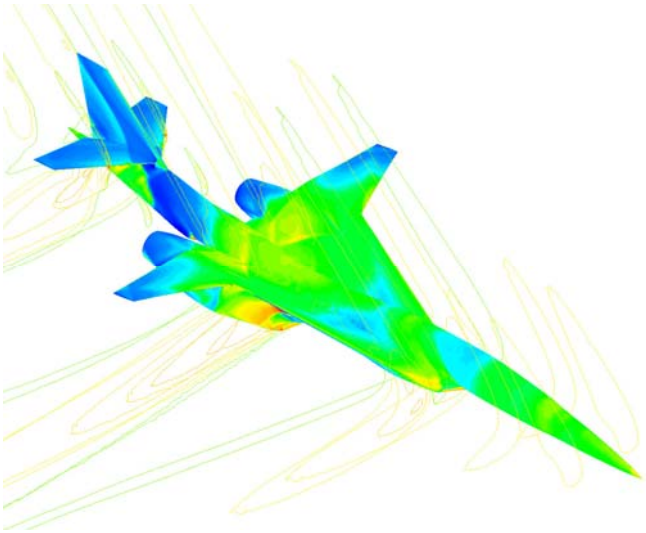

Fig.1 Pressure distribution around the low-boom configuration