IS-22

自動車の狭帯域騒音の予測

**The Prediction of Narrowband Noise Emitted from Real Vehicle Shape
(About the Use of the JSME Specification Template File)**

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Key Words : Aeroacoustic, Narrowband noise, Large scale simulation

Introduction

Aeroacoustic simulations play more and more important rule in vehicle industries due to the demanding of the riding quality. However, utilizing computational fluid dynamics (CFD) for the predication of the narrowband noise is still an extremely challenging task because of the necessity of solving flow and acoustic fields simultaneously, the complicated geometry and highly demanding of the accuracy of the numerical scheme. In order to overcome these issues, the immersed boundary and unified time stepping scheme developed by the authors [1] has been implemented in our in-house program, CUBE, for the compressible flow to investigate the feasibility of capturing the narrowband noise generated form the vehicle.

Governing Equation and Numerical Method

The low-Mach-fix for Roe (LMRoe) scheme with 5th order MSUCL reconstruction is utilized in convection term and 2nd order central difference is used for the viscous term. For the time advancement, the modified LUSGS based on adaptively switching the governing equation between the schemes with and without dual time stepping is adopted. In order to represent the complicated geometry in the Cartesian coordinate, the compressible immersed boundary developed by the author in [1] is used.

Result and discussion

The large scale simulation of nearly 2 billion meshes is performed by using 100 thousand cores for 50 hours at K-computer. The result shows that the narrowband noise generated from the gap between the hood and body can be clearly captured, which is consistent with the observation in the wind tunnel experiment.

Mesh distribution

Acoustic field from Top View

Acoustic field from Side View

Conclusion

Using the current framework to predict the narrowband noise, the computational cost can be tremendously reduced more than 10 times. It is shown that this method is suitable for the simulation of the vehicle aeroacoustics.

Reference

- [1] ChungGang Li, Makoto Tsubokura, Rahul Bale, "Framework for simulation of natural convection in practical applications", *Int. Commun. Heat Mass* Vol. 75 (2016), pp.52-58.