

고정밀 초대용량 CFD 해석 및 설계를 위한 공력 계산 틀

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ESSENTIAL COMPUTATIONAL TOOLS FOR VERY LARGE-SCALE, HIGH-FIDELITY CFD ANALYSIS AND DESIGN

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As the computing environment is rapidly improved, many researchers in CFD society are more and more focused on very large-scale computations over complex geometries. Keeping pace with the trend, domestic CFD society is also dramatically grown and the outcomes, including high-fidelity flow analysis and its application, are being closer to the top level of the world. In Korean CFD society, however, there is no standard code for very large-scale high-fidelity aerospace flow analysis and design problems, such as Overflow, CFL3D, and so on. As a result, most of domestic researchers employ their own limited computational tools that were developed for a specific class of problems. Thus, it would be meaningful to discuss essential computational tools to obtain solutions for very large-scale, high-fidelity CFD flow analysis and design problems. In addition, the way to contribute to the domestic CFD society is examined.

Firstly, we look over the promising CFD field to which very large-scale computation and Teraflop supercomputing is applicable and then we investigate not only the characteristics and structures of representative codes used in advanced countries, but also their applications. Finally, accurate and efficient flow analysis and design tools for very large-scale aerospace problems are presented. As building blocks, three different kinds of computational tools are presented: (1) high-fidelity numerical schemes - RoeM, AUSMPW+ and higher order interpolation schemes such as MLP (Multi-dimensional Limiting Process), (2) grid representation method - a general-purpose baseline code which can handle multi-block system and overset grid system simultaneously, (3) design optimization tool - sensitivity analysis treatment and geometric representation method to resolve complex flow characteristics. Exploiting these basic tools, the capability of the proposed approach to handle very large-scale aerospace simulation and design problems is tested by computing several flow analysis and design problems.

Key Words: 초대용량 유동 해석(Very Large-Scale Flow Analysis), 고정밀 수치기법(High-Fidelity Numerical Scheme), 겹침 격자 기법(Overset Grid System), 민감도 해석(Sensitivity Analysis), 매개 변수법(Adjoint Variable Method)

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