New calculation scheme for compressible Euler equation

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Key Words: Compressible Euler equation, Finite element method, NACA0012

F. De Vuyst (HAL Id : cel-00842234, ver. 1) suggests a new mathematical model for compressible Euler equation as follows:

\[
\begin{align*}
\frac{D\rho}{Dt} + \nabla \cdot \mathbf{u} &= 0, \\
\frac{1}{\rho} \frac{D\mathbf{u}}{Dt} + \nabla p &= 0, \\
\frac{Dp}{Dt} + \gamma \nabla \cdot \mathbf{u} &= 0, \quad p = \log(p).
\end{align*}
\]

In general, compressible fluid is calculated by using finite volume method (FVM) or discontinuous Gelerkin method (DGM), to guarantee high numerical calculation accuracy. However, these discretizing scheme is needed high calculation cost. The above mathematical model is able to be used standard Gelerkin method with lower calculation cost than FVM and DGM. In this presentation, NACA0012 is adopted as a first trial domain, and calculation results are very similar to previous results.

(a) Mach number and FEM mesh. (b) Pressure distribution on NACA0012.

Figure 1. Numerical simulation results.

REFERENCES

[1] F. De Vuyst, Numerical modeling of transport problems using freefem++ software - with examples in biology, CFD, traffic flow and energy transfer. HAL Id : cel-00842234, ver. 1