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THE ULTIMATE FINITE VOLUME SCHEME

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ABSTRACT

In this work we develop a general framework to derive and analyze staggered numerical scheme devoted to solve hydrodynamics equations. This framework creates a link between well-known staggered Lagrangian schemes (see [1] and references therein) and new cell-centered ones [2].

INTRODUCTION

In this work we develop... [3].

SECTION 1

In Lagrangian framework, 2D gas dynamics equations write

$$\rho \frac{d}{dt}\left(\frac{1}{\rho}\right) - \nabla \cdot U = 0, \qquad \rho \frac{d}{dt} U + \nabla P = 0, \qquad \rho \frac{d}{dt} E + \nabla \cdot (PU) = 0, \tag{1}$$

where ρ is the density, U the velocity and E the total energy. The first equation expresses the volume conservation equation, whereas the second and third ones are the momentum-total energy conservation equations. Volume conservation equation is often referred to as the Geometrical Conservation Law (GCL).
The previous system is equipped with a thermodynamics closure (equation of state EOS) $P = P(\rho, \varepsilon)$ where the specific internal energy is given by $\varepsilon = E - \frac{U^2}{2}$.

Subsection

The union of subcells Ω_{cp} that share a particular vertex p allows to define the (dual) vertex-centered cell Ω_p related to point p with $\Omega_p = \bigcup_{c \in \mathscr{C}(p)} \Omega_{cp}$. Primary cells Ω_c and dual cells Ω_p volumes are functions of time t. *We make the fundamental assumption that the subcells are Lagrangian volumes.*

Subsubsection.

Figure example as shown in Figure 1.

Table example as shown in Table 1.

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Thanks to everyone.

REFERENCES

[1] J. W. Smith. *The almost ultimate finite volume sheme.* Journal of Dead-End Idea, vol 442567, Elsebeer, 2013.

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FIGURE 1: Figure Caption here.

TABLE 1: Why my scheme is better than yours.

Schemes	CPU Time	Memory
Mine	1.5	5Mb
Your	24.3	200Mb
Their	44.2	235Mb

[2] J. W. Smith. *The almost ultimate finite volume sheme.* Journal of Dead-End Idea, vol 442567, Elsebeer, 2013.

[3] J. W. Smith. *The almost ultimate finite volume sheme.* Journal of Dead-End Idea, vol 442567, Elsebeer, 2013.