Δx
Δy
Δz
?
$_n s. An exhaustive description of the technique adapted to Cartesian grids is given in$ [**?**] $:$
$we shall only present here a few select details to expose the core of HYPERION.$
$_n s, we mix a finite-$
$volume flux-$
$balance formulation for the hyperbolic terms (_x$
$\mathbf{G}_y$
$\mathbf{H}_z$
$\mathbf{E}^v_{x,y,z}$
?
c

$$d\overline{\mathbf{U}}_c dt = -\hat{\mathbf{F}}_{i+1/2,j,k} - \hat{\mathbf{F}}_{i-1/2,j,k}\Delta x - \hat{\mathbf{G}}_{i,j+1/2,k} - \hat{\mathbf{G}}_{i,j-1/2,k}\Delta y - \hat{\mathbf{H}}_{i,j,k+1/2} - \hat{\mathbf{H}}_{i,j,k-1/2}\Delta z + \mathcal{D}_x\left(\mathbf{E}^{v,x}_c\right) + \mathcal{D}_y\left(\mathbf{E}^{v,y}_c\right) + \mathcal{D}_z\left(\mathbf{E}\right. \tag{1}$$

i
j
k
c
$i\pm$
$1/2$
$j\pm$
$1/2$
$k\pm$
$1/2$
$\hat{\mathbf{F}}$
$\hat{\mathbf{G}}$
$\hat{\mathbf{H}}$
$\mathbf{F}$
$\mathbf{G}$
$\mathbf{H}$

$$\hat{\mathbf{F}}_{i\pm 1/2,j,k} = \mathcal{U}\left(\mathbf{F}^L_{i\pm 1/2,j,k}, \mathbf{F}^R_{i\pm 1/2,j,k}, \overline{\mathbf{U}}^L_{i\pm 1/2,j,k}, \overline{\mathbf{U}}^R_{i\pm 1/2,j,k}\right), \tag{2}$$

$\mathcal{U}$
L
R
$\mathbf{F}$
$\overline{\mathbf{U}}$
$\hat{\mathbf{G}}_{i,j\pm 1/2,k}$
$\hat{\mathbf{H}}_{i,j,k\pm 1/2}$
τ
$\mathbf{q}$
φ
(i,j,k)
$d\in$
$\{x,y,z\}$

$$\partial\varphi_{i,j,k}\partial d = \mathcal{D}_d\left(\varphi_{i,j,k}\right), \tag{3}$$

$\mathcal{D}_d$
d
$\mathcal{D}^{(2)}_d$
$\mathcal{D}^{(4)}_d$

$$\mathcal{D}^{(2)}_d(\varphi_{i,j,k}) = \varphi_{i+1,j,k} - \varphi_{i-1,j,k} 2\Delta d, \tag{4}$$

$$\mathcal{D}^{(4)}_d(\varphi_{i,j,k}) = \varphi_{i-2,j,k} - 8\varphi_{i-1,j,k} + 8\varphi_{i+1,j,k} - \varphi_{i+2,j,k} 12\Delta d. \tag{5}$$

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et
$al.$
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?
5^{th}

$$\overline{\mathbf{U}}^L_{i+1/2,j,k} = \ \omega_1 \times \left[\overline{\mathbf{U}}^{L,1}_{i+1/2,j,k} = 16\left(-\overline{\mathbf{U}}_{i-1,j,k} + 5\overline{\mathbf{U}}_{i,j,k} + 2\overline{\mathbf{U}}_{i+1,j,k}\right)\right] + \omega_2 \times \left[\overline{\mathbf{U}}^{L,2}_{i+1/2,j,k} = 16\left(2\overline{\mathbf{U}}_{i,j,k} + 5\overline{\mathbf{U}}_{i+1,j,k} - \overline{\mathbf{U}}_{i+\right.\right. \tag{6}$$

$\omega_{1,2,3}$
ω_k
γ_k
$a.k.a.$