In-cell shock resolution: tracking vs sub-cell reconstruction. Application to sensitivity analysis

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1 General strategy

We consider the solution of a hyperbolic system of conservation laws:

$$\partial_t U + \partial_x F(U) = 0 \tag{1}$$

by a classical FV approach with a first order explicit update written as

$$\Delta x \frac{\bar{U}_i^{n+1} - \bar{U}_i^n}{\Delta t} + \hat{F}_{i+1/2} - \hat{F}_{ii1/2} = 0 \tag{2}$$

where $\bar{U}_i^n$ denotes the discrete approximation of the average of U over cell $i := [x_{i-1/2}, x_{i+1/2}]$ at time t^n, and where $\Delta x = x_{i+1/2} - x_{i-1/2}$, and $\Delta t = t^{n+1} - t^n$. As usual $\hat{F}_{i+1/2}$ denotes a numerical flux function of the left and right states $(U_{i+1/2}^-, U_{i+1/2}^+)$.

2 Tracking method

3 In-cell recontruction

4 Sensitivity equation: generalities

5 Numerical implementation

6 Results