

$$\left. \begin{array}{l} \text{PDEs : } \mathbf{U}_t + \mathbf{F}(\mathbf{U})_x = \mathbf{0} \ , \\ \text{ICs} \quad : \mathbf{U}(x, 0) = \mathbf{U}^{(0)}(x) \ , \\ \text{BCs} \quad : \mathbf{U}(0, t) = \mathbf{U}_l(t) \ , \ \mathbf{U}(L, t) = \mathbf{U}_r(t) \ , \end{array} \right\}$$

$$\mathbf{U}_i^{n+1} = \mathbf{U}_i^n + \frac{\Delta t}{\Delta x} [\mathbf{F}_{i-\frac{1}{2}} - \mathbf{F}_{i+\frac{1}{2}}] \ ,$$

$$\mathbf{F}_{i+\frac{1}{2}} = \mathbf{F}(\mathbf{U}_{i+\frac{1}{2}}(0)) \ .$$

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$$\left. \begin{array}{l} \mathbf{U}_t + \mathbf{F}(\mathbf{U})_x = \mathbf{0} \ , \\ \mathbf{U}(x, 0) = \left\{ \begin{array}{ll} \mathbf{U}_L & \text{if } x < 0 \ , \\ \mathbf{U}_R & \text{if } x > 0 \ , \end{array} \right\} \end{array} \right\}$$