Nodal Discontinuous Galerkin Method for the Euler Equations in GR

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1. Discontinuous Galerkin Scheme

We assume a spacetime metric

$$ds^2 = -\alpha^2 \, dt^2 + \gamma_{ij} \, dx^i \, dx^j, \tag{1}$$

and consider the system of conservation laws with sources

$$\partial_t \big(\sqrt{\gamma} \, \boldsymbol{U} \big) + \sum_{i=1}^{d} \partial_i \big(\alpha \, \sqrt{\gamma} \, \boldsymbol{F}^i(\boldsymbol{U}) \big) = \alpha \, \sqrt{\gamma} \, \boldsymbol{G}(\boldsymbol{U}), \tag{2}$$

where

$$\boldsymbol{U} = \big(D, \, S_j, \, \tau \big)^{\mathrm{T}} = \big(\rho \, W, \, \rho \, h \, W^2 \, v_j, \, \rho \, h \, W^2 - p - D \big)^{\mathrm{T}}, \tag{3}$$

$$\boldsymbol{F}^i(\boldsymbol{U}) = \big(D \, v^i, \, \big)^{\mathrm{T}} \tag{4}$$

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