

ADMConstraints

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Abstract

Calculate the values of the Hamiltonian and Momentum Constraints on the computational grid for output.

1 Physics

This analysis thorn calculates the values of the Hamiltonian and momentum constraint equations on the computational grid during a spacetime evolution. The Hamiltonian Constraint (grid function: ham) is given by

$$H = R - K^i_j K^j_i + trK^2 - 16\pi\rho \quad (1)$$

The Momentum Constraints (grid functions momx, momy, momz) are given by

$$M_i = \nabla_j K_i^j - \nabla_i trK - 8\pi S_i \quad (2)$$

where

$$S_i = -g_{ia}n_b T^{ab} = -g_i^a n^b T_{ab} = -\frac{1}{\alpha}(T_{i0} - \beta^j T_{ij}) \quad (3)$$

2 Comments

- Symmetry boundary conditions (`CactusBase/CartGrid3D`) are implemented.
- Default behaviour is to apply so called flat boundary conditions to the calculated values of the constraint equations.
- Excision (`Excision/LegoExcision`) is included.
- The 3-metric is only included through the Macros in `CactusEinstein/Einstein` and as such the physical metric is used.
- Matter is included using the `CalcTmuNu` mechanism.
- The constraint calculation is default performed at the ANALYSIS time bin, if the constraint values are needed at every iteration, the parameter `constraints_persist` should be used to schedule the calculation instead at POSTSTEP.