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

\[ H = R - K^i_j K^j_i + trK^2 - 16\pi\rho \]  

(1)

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

\[ M_i = \nabla_j K^j_i - \nabla_i trK - 8\pi S_i \]  

(2)

where

\[ S_i = -g^a_i a^b T^{ab} = -g^a_i \epsilon^b T^{ab} = -\frac{1}{\alpha} (T_{i0} - \beta^j T_{ij}) \]  

(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.