Explicit methods for hyperbolic systems on unstructured tent meshes

List of authors:

J. Gopalakrishnan [1]

Tent-shaped spacetime regions appear to be natural for solving hyperbolic systems because one can ensure causality by constraining the height of the tent pole. Specifically, the domain of dependence of all points within a tent can be guaranteed to be contained within the tent by constraining the tent pole height. Moreover, a spacetime simulation region can be covered by advancing fronts of such tents. In this talk, we review known techniques to advance the numerical solution of a hyperbolic problem by progressively meshing a spacetime domain by tent shaped objects. Then we introduce new schemes, called Mapped Tent Pitching (MTP) schemes, which proceed by transforming tents into domains where space and time are separated, allowing standard methods to be used within tents. This technique also allows, for the first time, the use of fully explicit schemes within tents. After highlighting certain difficulties that arise with naive use of standard explicit Runge-Kutta time stepping algorithms in this context, the talk will conclude with themes from ongoing research into new explicit MTP schemes.

References

[1] J. Gopalakrishnan, J. Schöberl, and C. Wintersteiger. Mapped tent pitching schemes for hyperbolic systems. *SIAM Journal on Scientific Computing*, 39(6):B1043–B1063, 2017.

[1]Portland State University, PO Box 751, Portland, OR 97207-0751, USA (gjay@pdx.edu).