

THE ACTIVE FLUX METHOD: THEORY, NUMERICS AND APPLICATIONS

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ABSTRACT

The Active Flux method is a hybrid finite element - finite volume method that achieves upwinding by locally evolving continuous data, instead of solving Riemann problems. Typically its degrees of freedom are cell averages and point values located at cell interfaces, the latter being shared between adjacent cells. The solution has a globally continuous representation. The evolution of the averages is conservative, which means this is a finite volume method that is able to converge to the weak solution. This method was proposed by Phil Roe around 15 years ago. He suggested a 3rd order method that can be found in the literature under the name of *Active Flux*. Since then it has been shown to achieve superior results on coarse grids, because it preserves multi-dimensional structures of the flow. In recent developments Active Flux was made arbitrarily high-order accurate.

In this mini-symposium we want to study i.) theoretical properties of this method, ii.) its various numerical implementations and iii.) how the method fares in applications. Regarding i.) one has been able to prove structure preserving properties of the method for linearized equations, so how to proceed for non-linear equations? As to ii.) one has understood some relationship between different numerical implementations of the method, so which version is best in a given context? Finally with respect to iii.) the application of Active Flux to computational astrophysics has made progress with very promising results, this and other applications needs to be pushed further.

This mini-symposium will bring together experts to discuss these topics and move the subject forward.

SPEAKERS

1. Junming Duan (Chinese Univ. of Hongkong): Bound-preserving active flux methods for compressible flows.

2. Christiane Helzel (Düsseldorf University, Germany): A fully discrete Active Flux method for the Euler equations comparing different truly multi-dimensional evolution operators.
3. Christian Klingenberg (Würzburg University, Germany): The Active Flux method: theory, numerics and applications
4. Simon Krotsch (Würzburg University, Germany): Active Flux and the Korteweg-De Vries equation
5. Giovanni Leidi (Univ. of Graz, Austria): Stellar astrophysics simulations using a 3rd-order Active Flux method.
6. Yongle Liu (University of Trento, Italy): A positivity- and stationarity-preserving Active Flux-type scheme for hyperbolic balance laws: the PAMPA framework.
7. Giacomo Lorelli (Würzburg University, Germany): Active Flux and astrophysical applications
8. Nikhil Manoj (Würzburg University, Germany): Active Flux applied to shallow water with Coriolis force
9. Chad Meyer (Los Alamos National Lab, USA): Multi-species flow and the Active Flux scheme