6-22-2015

The following goals were outlined for the next meeting:

1. **Obtain multidimensional results for explicit FCT**. In progress.
2. **Compare symmetric limiter with upwind limiter**. The symmetric limiting coefficients have the following definition:
$$L_{i,j} = \begin{cases} \min\{R_i^+, R_j^-\}, & F_{i,j} > 0 \\ \min\{R_i^-, R_j^+\}, & F_{i,j} < 0 \end{cases}, \tag{1}$$
while the upwind-biased limiting coefficients have the following definition:
$$L_{i,j} = \begin{cases} R_k^+, & F_{i,j} > 0 \\ R_k^-, & F_{i,j} < 0 \end{cases}, \tag{2}$$
where k is the upwind node of i and j. It is noted here that, unlike the symmetric limiting coefficients, the upwind-biased limiting coefficients do not necessarily satisfy the discrete maximum principle. This is disproved here by a counterexample. Recall that the discrete maximum principle is satisfied when $Q_i^- \leq \sum_j L_{i,j}F_{i,j} \leq Q_i^+$. Suppose a node i has a single neighboring node $i-1$, and that this neighbor is upwind of i. For example, this is the case for a 1-D domain on the outflow boundary. Thus there is a single correction flux $F_{i,i-1}$: $\sum_j L_{i,j}F_{i,j} = L_{i,i-1}F_{i,i-1}$. Now suppose that without limitation, this correction flux would exceed the upper bound Q_i^+, i.e., $F_{i,i-1} > Q_i^+$. Suppose further that $P_{i-1}^+ \leq Q_{i-1}^+$. Then,
$$\sum_j L_{i,j}F_{i,j} = L_{i,i-1}F_{i,i-1} = R_{i-1}^+ F_{i,i-1} = \min\left\{1, \frac{Q_{i-1}^+}{P_{i-1}^+}\right\} F_{i,i-1} = F_{i,i-1} > Q_i^+,$$
which violates the DMP condition.
3. **Determine if converged steady-state results match transient results**. In progress.
4. **Determine how to evaluate analytic DMP bounds in multidimensional problems**. In progress.
5. **Compare time step size computed from $1 - \frac{\Delta t}{m_i}A_{i,i}^L$ to that obtained by examining the eigenvalues of $(\mathbf{M}^L)^{-1}\mathbf{A}^L$**. In progress.
6. **In the source-void-to-absorber problem, ramp the source from zero instead of instantaneously adding the source**. In progress.
7. **Determine if Kuzmin's implicit bounds are equal to our implicit bounds**. In progress.
8. **Evaluate the benefit of Kuzmin's "prelimiting" step**. In progress.

The following suggestions were made:

- archive all results found, with code version number and descriptions of run parameters
- create a test suite to determine if code updates break the code