Advection scheme for unstructured meshes

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We propose a new scheme for the advection step of an A.L.E. hydrocode. A well known issue for this kind of scheme is to preserve maximum principle for velocity and conservation of momentum since density and velocity are usually not localised (cell centered for thermodynamic quantities and nodes for velocity). The scheme is also designed to handle unstructured meshes (triangles and quadrangles with arbitrary connectivity). Basically, the problem is the following, let K^A a given mesh and $(\rho^{K^A}, \mathbf{u}^{K^A})$ known at (cells,nodes), we have to define new quantities $(\rho^{K^N}, \mathbf{u}^{K^N})$ at (cells,nodes) on K^N, an other given mesh.
Our scheme is based on three steps. First, we define for each mesh (K^A, K^N) a "finer mesh" (FK^A, FK^N) in such a way that any variable is now defined *ONLY on cells* of FK^A, FK^N and all of them are *localised*. So, we begin with a "transfer" phase (called TCF : coarse to fine)

$$\begin{pmatrix} \rho \\ \mathbf{u} \end{pmatrix}^{K^A} \overset{TCF}{\rightarrow} \begin{pmatrix} \rho \\ \mathbf{u} \end{pmatrix}^{FK^A}$$

it is followed by a cell "projection" phase between FK^A and FK^N (called PF2F : fine to fine)

$$\begin{pmatrix} \rho \\ \mathbf{u} \end{pmatrix}^{FK^A} \overset{PF2F}{\Rightarrow} \begin{pmatrix} \rho \\ \mathbf{u} \end{pmatrix}^{FK^N}$$

and finally, we end with an other "transfer" (called TFC : fine to coarse)

$$\begin{pmatrix} \rho \\ \mathbf{u} \end{pmatrix}^{FK^N} \overset{TFC}{\rightarrow} \begin{pmatrix} \rho \\ \mathbf{u} \end{pmatrix}^{K^N}$$