Global adaptivity for least squares moving finite elements

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MFE fails on steady-state convection problems because the nodes continue to drift with the flow. Instead, recent least squares MFE works well on steady pure convection problems in 2-D (work with Mike Baines, 1998). A further improvement is an area-weighted version of LSMFE. Both methods yield far better results than fixed node methods. Nevertheless, it has long been clear that a truly robust and efficient moveable node code must include not only continuous deformation of the grid as in MFE or equidisdribution, but also "global adaptivity" (addition and deletion of nodes, edge-swaps). Andrew Kuprat made a good start at it in his thesis (UC Berkeley '93) for transient problems, but this turns out to be an even more difficult problem for steady-state hyperbolic problems because the nodes must align with the flow and occasional "logjam" cells can sit astride the flow. I'll show preliminary results on work with Diogo Gomes and Neil Carlson incorporating global adaptivity into LSMFE, with application to hyperbolic systems such as the shallow water equations. So far the logjam problem is not satisfactorily resolved (but perhaps we'll have some real improvements by the time of the meeting).