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LOCAL ABSORBENT BOUNDARY CONDITION FOR NONLINEAR HYPERBOLIC PROBLEMS WITH UNKNOWN RIEMANN INVARIANTS

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Abstract. A general methodology for developing absorbing boundary conditions for general non-linear advective-diffusive system of equations is presented. In problems where the Riemann invariants are known (e.g. the flow in a shallow rectangular channel, the gas flow equations), the superimposition of non-reflective boundary conditions is straightforward. In problems where Riemann Invariants are unknown (e.g. the flow in a non-rectangular channels, the stratified two-dimensional (2D) shallow water flows) it is possible to impose that kind of conditions analyzing the projection of the Jacobians of advective flux functions onto normal directions to fictitious surfaces. Moreover, with the technique proposed here the state variables of the system can be force to achieve a given "reference state". The advantage of the method is that is very easy to implement it in a production finite element code and that is based on imposing non-linear constraints via Lagrange Multipliers and/or Penalty Methods. The application of the dynamic absorbing boundary conditions to typical wave propagation problems with unknown Riemann Invariants, like non-linear Saint-Venant system of conservation laws for non-rectangular and non-prismatic one-dimensional channels and stratified 2D shallow water equations, is presented.