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Implicit Time Integration Schemes for a Finite Element Two-Fluid Plasma Code BHUVANA SRINIVASAN, URI SHUMLAK, Aerospace & Energetics Research Program, University of Washington — The two-fluid model consists of the complete Euler equations for the ion and electron fluids and Maxwell's equations for the electric and magnetic fields. Two-fluid effects become significant when the characteristic spatial scales are on the order of the ion skin depth and the characteristic time scales are on the order of the inverse ion cyclotron frequency. In regimes where two-fluid physics is significant, it is necessary to account for the Hall term and the diamagnetic drift term that are missed in single-fluid MHD. WARPX is a finite element code based on the two-fluid plasma model which uses the Runge-Kutta discontinuous Galerkin method. The two-fluid plasma model has characteristic speeds ranging from the fluid sound speeds to the speed of light. As a result, the explicit time stepping schemes have a very restrictive time step governed by either the speed of light or the electron plasma frequency. This provides the motivation to study implicit time stepping schemes for the two-fluid plasma model where accuracy considerations alone determine the time-step.

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