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Variational integration for ideal MHD with built-in advection equations¹ YAO ZHOU, HONG QIN, JOSHUA BURBY, AMITAVA BHATTACHARJEE, Princeton Plasma Phys Lab — Newcomb’s Lagrangian for ideal MHD in Lagrangian labeling is discretized using discrete exterior calculus. Variational integrators for ideal MHD are derived thereafter. Besides being symplectic and momentum-preserving, the schemes inherit built-in advection equations from Newcomb’s formulation, and therefore mitigate numerical resistivity significantly. We implement the method in 2D and show that it does not suffer from numerical reconnection when singular current sheets are present. We then apply it to studying the dynamics of the ideal coalescence instability with multiple islands. The relaxed equilibrium state with embedded current sheets is obtained numerically.

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