First steps towards hybrid drift-kinetic-MHD simulations using FEEC

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We report on the progress regarding the development of a new code which solves the linear ideal magnetohydrodynamics (MHD) equations which are nonlinearly coupled to a drift kinetic equation in the low-frequency regime. Such so-called hybrid models are suitable to describe the self-consistent interaction of a thermal fluid bulk plasma with an ensemble of energetic particles e.g. in the context of magnetic confinement fusion. The goal of the present work is to explore the usage of numerical methods which are related to finite element exterior calculus (FEEC) with the aim to preserve as many properties of the continuous model as possible, e.g. conservation of energy, div(B)=0 for the magnetic field or ideally the full Hamiltonian structure. Starting from a motivating example from 1D, we present the considered model with its possible coupling schemes between the fluid and kinetic species (current coupling scheme/pressure coupling scheme), explain key points of our discretization including how to treat curved geometries and show first numerical results.