Hybrid plasma model simulations of a plasma opening switch\textsuperscript{1}
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Plasma models have regimes of validity that depend on local parameters. In some
problems a computationally expensive model is required in a small subset of the
domain while faster reduced models can adequately describe the plasma behavior
everywhere else. Partitioning the domain and using the simplest plasma model that
is locally valid can maintain global physical fidelity while improving computational
efficiency. Coupling between the models is handled using boundary conditions to
convert the variable set of one constituent model to that of another. This research
investigates the coupling between MHD and two-fluid plasma models using a physics-
based domain-decomposition. Comparisons are made on accuracy and performance
of using a hybrid plasma model with a single conventional plasma model on the
planar plasma opening switch. The setup consists of a low density background and
a high density bulk plasma with a large density gradient, leading to drift instabilities
which are not captured by MHD models. However, elsewhere MHD models provide
sufficient accuracy. Collisional transport and non-ideal MHD effects are also inves-
tigated to determine which parameter regimes require these processes in order to
gain physical fidelity.

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