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Port-Hamiltonian Formulation of Cable Harnesses with Radiation Effects

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We consider cables that interact with the electromagnetic field through radiation in a bidirectional way. We show that the port-Hamiltonian framework is well-suited to model this interaction. The cable is described by the telegraph equations, while the electromagnetic field is (unsurprisingly) described by Maxwell's equations. The coupling goes via boundary conditions for the electric and magnetic fields at the lateral surfaces of the cables, and is determined by the voltages and currents along the transmission line. Additionally, we discuss some analytical properties, including the semigroup property of the autonomous dynamics.

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