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Why the resistive magnetohydrodynamic equations do not form a closed system ROBERT JOHNSON, unaffiliated — The usual resistive MHD equations, defined as a system of 14 scalar equations in 14 scalar variables, conventionally are determined to be complete and soluble. These equations are a combination of Navier-Stokes and a subset of Maxwell's. However, one of the vector equations, Faraday's law, is actually an identity when viewed from the potential formulation of electrodynamics, hence does not determine any degrees of freedom. The error arises from attributing six degrees of freedom to the electromagnetic fields, when the Maxwell field tensor has only four physical degrees of freedom which are coupled to sources given by the four-current. Only by reinstating Gauss' law does the system of equations become closed, bringing the number of scalar equations and degrees of freedom into agreement with the number twelve. The homogeneous Maxwell equations are recognized as the Bianchi identity for the field tensor coupled to the sources through the inhomogeneous field equations.

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