Numerical solution of transient nonlinear axisymmetric eddy current models with hysteresis *

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Abstract

This work deals with the mathematical analysis and the computation of transient electromagnetic fields in nonlinear magnetic media with hysteresis. The result of this work complements the content of [1], where existence of the solution has been proved under fairly general assumptions on the **H**–**B** curve, namely, the nonlinear constitutive relation between the magnetic field **H** and the magnetic induction **B**. In our case, the constitutive relation between **H** and **B** is given by a hysteresis operator, i.e. the values of magnetic field not only depends on the present values of magnetic induction but also on the past history. Like in [1], we assume axisymmetry of the fields and then consider two kinds of boundary conditions. Firstly the magnetic field is given on the boundary (Dirichlet boundary condition). Secondly, the magnetic flux through a meridional plane is given, leading to a non-standard boundary-value problem. For both problems, under suitable assumptions, an existence result is achieved. The technique we use is based on implicit time discretization, a priori estimates and passage to the limit by compactness (see, for instance, [3] and [2]). Finally we consider an application: the numerical computation of eddy current losses in laminated media as those used in transformers or electric machines.

References

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