A METAOPTIMIZATION APPROACH TO THE PARETO OPTIMAL DESIGN OF MULTIPLE WINDINGS SOLENOIDS

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Abstract

The optimization of air cored solenoids, when homogeneity of internal magnetic field and stray field value are stated as objectives, seems to be a particularly suited problem to test various non deterministic shape optimization techniques.
In this direction various configurations of actively shielded solenoids with multiple windings are considered, starting from the simplest Loney-like with 3 windings and 2 design variables up to a more realistic one with 8 windings and 8 design variables.
In all cases a detailed study of both objective functions has been made to justify the use of an evolution strategy algorithm; a goal attainment formulation of the multicriteria has been chosen and tested for all coils configurations .
When using nondeterministic optimization algorithm it is common that efficiency of the method heavily depends on various parameters that must be tuned correctly for every different problem to be solved. In order to set the best tuning of parameters of a given algorithm the latter could be considered as auxiliary design variables; this way a metaoptimization procedure has been performed.
Finally a Pareto optimal set evaluation has been implemented to solve the problem of the starting point-solution sensitivity; a possible Pareto optima sorting criterion is proposed as an opportunity for the designer to chose among a set of Optimal solutions.

References

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