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Optimisation algorithms for magnetics and their parallelizability

Several algorithms are available for optimizing the design synthesis of electromagnetic products through an iterative cycle. In recent years, these algorithms have been modified for efficient implementation on parallel computer architectures and compared. This paper examines two aspects of this parallelization in the context of the optimization of electromagnetic products using finite element analysis for purposes of design.

First, the comparisons that have been made are usually done with simple mathematical functions and are not useful in true engineering design. For instance, an algorithm taking several function evaluations-like random search methods-might be highly parallelizable, but the comparison based on function evaluations with simple object functions like the Rosenbrock function will not be valid when applied to a magnetic field problem where each function evaluation is a finite element solution. Thus the number of function evaluations also must be factored into the comparison, rather than simple iteration counts.

Second, much of the parallelization with finite elements is done shared memcry systems where the number of processors is limited. In such a limited processor environment, if each processor is used in parallelizing the optimization algorithm, the finite element computation that accompanies each object function evaluation cannot be parallelized since no processor is free for that.

As such, in conclusion, an essentially sequential optimization algorithm like simulated annealing could be as effective if the object function evaluations are parallelized.