Abstracts

Modeling microwave and hybrid heating processes including heat radiation effects

This paper presents an efficient simulation tool for conventional, microwave, and combined heating. Two heat-transfer mechanisms are included: conductive and radiant heat transfer. The conductive heat transfer is modeled by a finite-difference algorithm. A modeling technique for radiant heat transfer in nonuniform grids has been developed and is here presented for the first time. For the radiant heat transfer a finite-difference scheme is not applicable, as radiation from a material surface; is not bounded to the immediate vicinity, as is conductive heat transfer. Therefore, ray optical methods are used. Rays connecting mutually visible surfaces are obtained by a new fast method. Necessary, but acceptable simplifications allow fast computations. The algorithms are integrated conveniently together with an electromagnetic finite-difference time-domain program to one simulation tool. Representative simulations are presented for an oven heated conventionally, by microwaves, and by a combination of both.

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