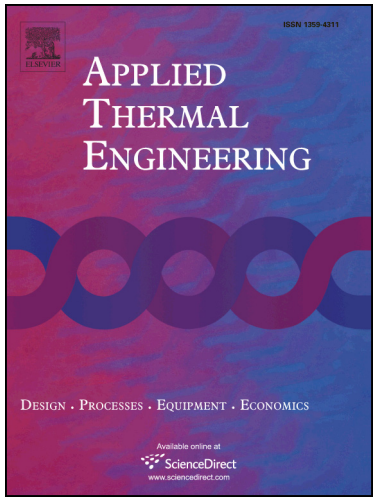

A review about the engineering design of optimal heat transfer systems using topology optimization

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A review about the engineering design of optimal heat transfer systems using topology optimization

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Topology Optimization (TO) is a promising numerical technique for designing optimal engineering designs in many industrial applications. It is expected that it might become an unavoidable engineering tool for many new rising technologies such as the additive manufacturing or metal 3D printing as addressed recently in the literature. During the last fifteen years, several TO methods have been developed for optimizing thermal systems based on conductive, convective and conjugate heat transfer. These numerical methods and tools are dispersed in the literature, and there are no enough comparisons between them which makes one doubts their real capabilities in finding really optimal designs. This paper presents a review about TO design methods that have been developed during the last 15 to 20 years to design optimal heat transfer systems. Each numerical method is presented briefly with an emphasize on its advantages, disadvantages, limitations and perspectives. Finally, this review shows that TO today is not yet a robust numerical design technique for finding optimal designs of thermal systems.

Nomenclature

$\boldsymbol{x}$ = Design variable vector

P = Pressure (Pa)

p = Interpolation parameter

$\boldsymbol{v}$ = Velocity vector (m/s)

T = Temperature (K)

f_0 = Objective function

α = Brinkmann penalization coefficient

ϕ_{max} = Maximum volume fraction

k_{eff} = Effective thermal conductivity W/(m·K)