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MULTIOBJECTIVE TOPOLOGY OPTIMIZATION APPLIED TO CONJUGATE HEAT TRANSFER PROBLEMS

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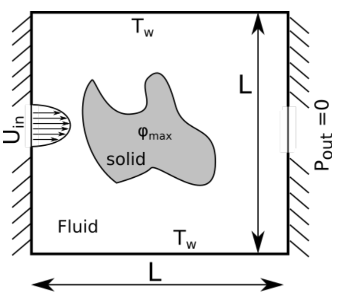
A Multiobjective topology optimization solver is developed based on the continuous adjoint method for the purpose of designing optimal designs for 3D conjugate heat transfer applications. The adjoint equations with the boundary conditions formulations were derived and coupled to a 3D Finite volume CFD in-house code, and to the MMA (The Method of Moving Asymptotes [1]) in addition to bi-material distribution laws. Two objectives were considered into account in order to minimize the total pressure power loss in laminar flow and to maximize the thermal power in the system depending on the users' choice (i.e. a weighting factor parameter) and by respecting the *KKT* conditions. The present developed new solver is applied to a 2D case study very well known in the literature (Figure 1). The geometrical design is a square domain based made of one fluid inlet, and one fluid outlet with multiple walls that can be adiabtic or at constant wall temperature as boundary conditions (BC). A temperature gradient is imposed initially such that ($\Delta T = T_{wall} - T_{inlet} \neq 0$).
We found topological structures showing interesting optimal shapes (Solid/fluid) (see figure 2, the flow is in *x*). The bi-objective pareto frontier that is computed upon varying several conditions (i.e. Reynolds number, ΔT, symmetry, assymetry BC, diffusivity ratio, mesh quality, etc). At similar conditions taken from literature cases [2], we found that the present topological structures are completely different from what was observed previously. Comparisons are done in terms of the topologies obtained and the bi-objective parento frontier values. Our present findings question the validity of the implementation of objective functions, adjoint systems and the boundary condtions applied in a *continuous* or *discrete* fashion, coupled to the choice of the numerical solution method/technique.



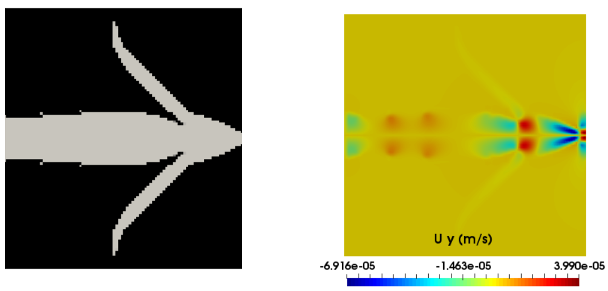


Fig.1 Numerical Case **Fig.2** optimal structure (for max. thermal power at $\varphi_{max} \leq 0.4$)

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