

MAP562 Optimal design of structures

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Exercise 1

1. For a constant heat source $v \in \mathbb{R}$, using a gradient method, implement in FreeFem++ the minimization of the functional:

$$J(v) = \int_{\Omega} |T - T_0|^2 dx$$

where

$$\begin{aligned} -\Delta T + u \cdot \nabla T &= 1_{\omega} v \quad \text{in } \Omega \\ T &= 0 \quad \text{on } \partial\Omega, \end{aligned}$$

and $\Omega = (0,1)^2$ and ω a ball with radius 0.1 and where $u = [6,2]$ is a constant velocity. Furthermore, the temperature to be matched is $T_0 = 10$.

2. (Not in a FreeFem script, but just for yourself) Compare your results to Homework 2. What is the main difference?
3. Implement a 2nd FreeFem script in which the trick, $T(v) = T(1)v$ is replaced by the general approach using an adjoint equation.

Remark:

Please upload your solutions as separate files on

<http://www.cmap.polytechnique.fr/~MAP562/>