

Doing two things at once

is sometimes harder than just doing two things at once

- **Naive numerical method**

- Solving just for the body (resp. just for the fluid) gives a boundary condition for the fluid (resp. for the body)
- Guess some initial boundary conditions, and use to solve for one part, then use the solution to solve for the other part, giving new boundary conditions, and... iterate
- Problem: rate of convergence depends on initial guess, and there is no systematic way beyond trial and error

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- **Analytic reduction**

- Sometimes multiphysics problems can be reduced “purely formally”
- ... *sometimes*
- *The problem of heat exchange between two fluid streams in boundary layer flow separated by a flat plate is considered. A general analysis applicable to cocurrent or countercurrent, laminar or turbulent flow is presented. An exact solution for the temperature distribution and the heat transfer along the plate is obtained **for the special case of constant property, cocurrent, inviscid flow**. ([DOI:10.1016/0017-9310\(71\)90180-3](https://doi.org/10.1016/0017-9310(71)90180-3))*