ME-474 Numerical Flow Simulation

Assessment #2

Fall 2022

I. Guidelines

For this second assessment, you will use Fluent to perform a full CFD study from pre-processing to setup and simulation, to post-processing and analysis.

You have two options: (i) choose one of the topics suggested below, or (ii) choose a topic of your own. In case (ii), it is advised that early enough you send me by email a short description of what you plan to study (you can use for instance the "specification template" available on Moodle); it will not be graded, the aim is to make sure that your topic is suitable for the scope of this assessment.

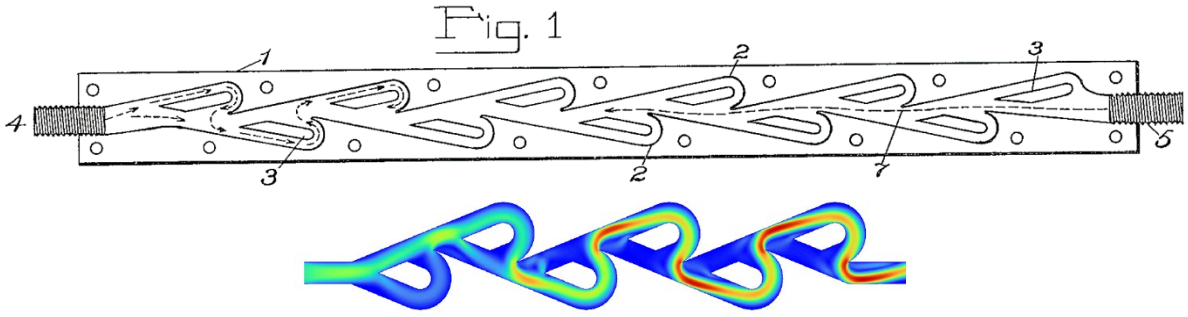
In any case, remember to follow the guidelines presented in the lecture slides of week 1 (e.g. 2D or axisymmetric problem, no solid thermal conduction, no two-way coupling fluid-structure interaction, etc.).

Write and submit one single report per group (one single pdf file) by January 6, 2023. You may use the report template available on Moodle, which will be commented later in class.

II. Examples of topics

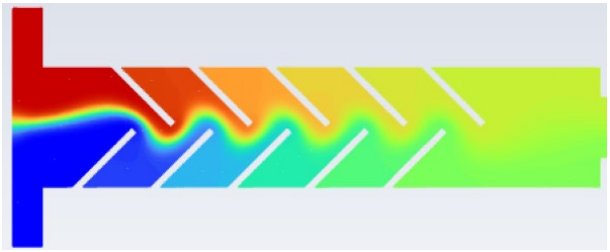
1. Tesla valve (fluidic diode)

Study how the relationship between flow rate and pressure drop depends on the flow direction (and possibly on the geometry, number of cells etc.).



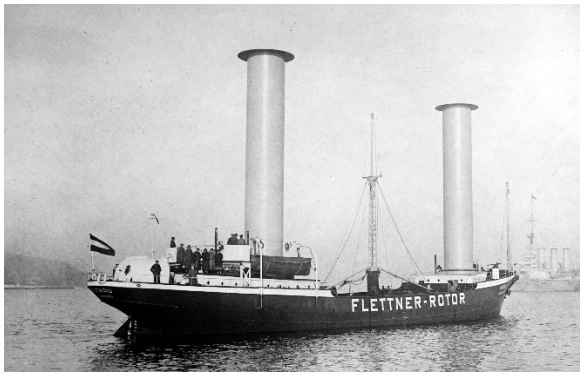
2. Laminar mixing device

Compare two (or more) geometries of devices aiming at mixing two miscible fluids in the laminar regime, without moving parts or external forces. Typical application: mixing of biomedical/chemical fluids at small scales.



3. Flettner rotor (Magnus effect of a rotating cylinder)

Study the aerodynamic coefficients of a rotating cylinder at different rotation rates. You may compare potential theory, inviscid CFD and viscous CFD. Typical application: ship propulsion.



4. Paraglider wing

Study the aerodynamic coefficients of a paraglider wing at different angles of attack (and possibly different speeds). Investigate the admissible operating conditions to avoid not only stall (like conventional rigid airfoils) but also wing collapse.

5. Airfoil in ground effect

Study the aerodynamic coefficients of an airfoil in ground proximity. Compare different values of ground clearance (distance between ground and airfoil), including an infinite clearance (no ground). Typical applications: race car, airplane landing/takeoff.

6. Pitching/heaving airfoil

Study the aerodynamic coefficients of an airfoil that flaps in a pitching, heaving, or combined motion. Typical applications: insect/bird/fish propulsion, small unmanned aerial vehicles.