UNIVERSITÀ DEGLI STUDI
DI GENOVA

Thesis Projects
in
Fluid Dynamics

The power of teamwork: a drag reduction study

We can find several examples in nature where cooperative work can lead to beneficial outcomes. Bird migration is one example where the correct formation (usually similar to a V) can help the flock by taking advantage of the updraft due to the wing tip vortices shed of the bird in front. This allows the birds to lower the heart beat and increase the flying range. The scope of this project is to study under what conditions drag reduction is achieved for a "flock" of bodies on which flexible filaments have been attached. The work is numerical and consists of investigating the effect on drag due to the position of the bodies, stiffness, length, and weight of the attached filaments. The work will be conducted using an existing numerical code solving the underlying conservation equations for mass and momentum (Navier-Stokes equations), for incompressible Newtonian fluids, and the structure (flexible filaments with prescribed mass and bending stiffness) are modeled using an immersed boundary technique.

A close collaboration will be maintained during the project with the Department of Mechanics at the Royal Institute of Technology in Stockholm, Sweden.
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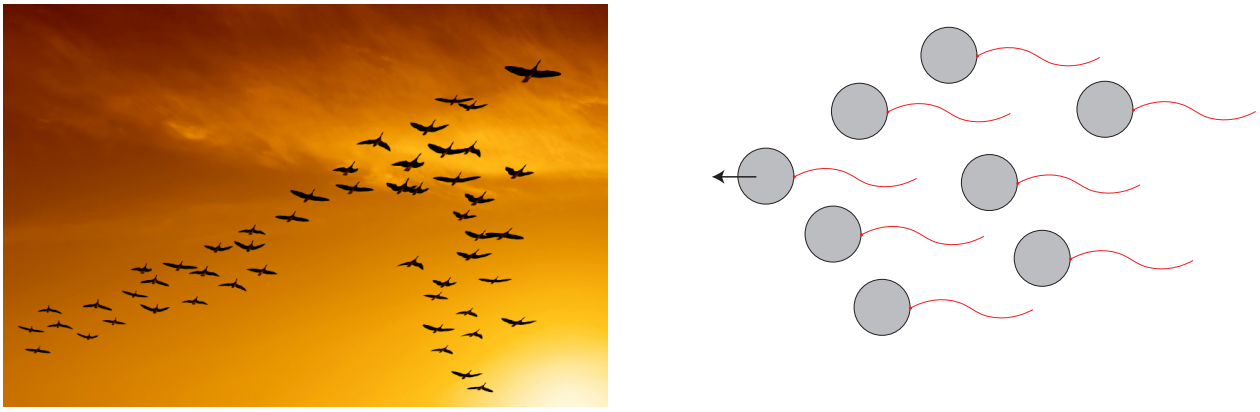

Figure 1: A V-formation (left) of flying birds enhance their efficiency to migrate. More generally (right), what is the minimum drag of N moving bodies with flexible elastic filaments ? Are there any cooperative or synchronization effects?