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BOOK OF ABSTRACTS

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Minimum energy control of passive tracers advection in point vortices flow

July,3
17:45
Control in Point Vortex Dynamics

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In this work we are interested in controlling the displacement of particles in interaction withN-point vortices, in a two-dimensional fluid and neglecting the viscous diffusion. We want to drive a passive particle from an initial point to a final point, both givena priori, in a given finite time, the control being due to the possibility of impulsionin any direction of the plane. For the energy cost, the candidates asminimizers are given by the normal extremals of the Pontryagin Maximum Principle (PMP). The transcription of the PMP gives us a set ofnonlinear equations to solve, the so-called shooting equations. We introduce these shooting equations and present numerical computationsin the cases of N=1,2,3 and 4 point vortices. In the integrable case N=1, we give complete quadratures of the normal extremals.

Passive Particle Dynamics in Viscous Vortex Flow

July,3
18:05
Control in Point Vortex Dynamics

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We focus on the description of point vortices both in inviscid and viscous environments and try to extend the idea of quantification of chaos in inviscid vortex systems of Babiano et al. to viscous environments. In particular, we notice that viscosity can disrupt stable dynamics and cause initially stable trajectories to go through chaotic behavior, before succumbing to viscosity completely. We also find that the logarithms of the duration of this chaotic behavior and the kinematic viscosity coefficient seem to be connected by a linear relationship. Most approaches to control of point vortices don't take viscosity into account. This should not be what one expects from most real fluids. As such, it is important to take viscosity into account to try to obtain better descriptions and solutions of real world problems.

Optimal route planning in steady planar convective flows

July,3
18:25
Control in Point Vortex Dynamics

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We consider the following optimal control problem with state constraints: find optimal route between two given points in a planar steady convective flow. The cost function is a weighted sum of the total travelling time and the energy spent by the controller. The optimal control problem is solved numerically by using an indirect method based on Pontryagin's Maximum Principle in the Gamkrelidze's form. Optimal routes are computed and discussed for three examples of convective flows.
