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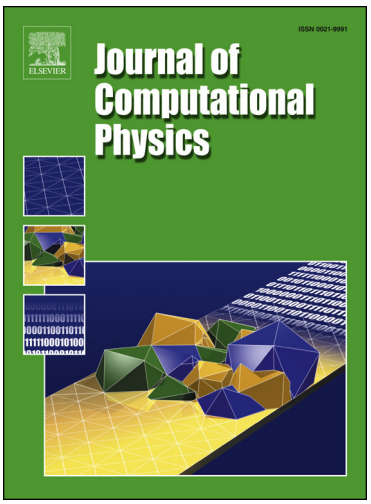


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Michel Bergmann, Angelo Iollo

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# Bioinspired Swimming Simulations

Michel Bergmann[a,b,c,*], Angelo Iollo[a,b,c]

[a] *Memphis Team, INRIA, F-33400 Talence, France.*
[b] *Univ. Bordeaux, IMB, UMR 5251, F-33400 Talence, France.*
[c] *CNRS, IMB, UMR 5251, F-33400 Talence, France.*

**Abstract**

We present a method to simulate the flow past bioinspired swimmers starting from pictures of an actual fish. The overall approach requires i) a skeleton graph generation to get a level-set function from pictures; ii) optimal transportation to obtain the velocity on the body surface; iii) flow simulations realized with a Cartesian method based on penalization. This technique can be used to automate modeling swimming motion from data collected by biologists. We illustrate this paradigm by simulating the swimming of a mackerel fish.

*Keywords:* Bioinspired Swimming, Level Set, Skeleton, Optimal transportation, Cartesian mesh, Penalization

## 1. Introduction

Autonomous swimming robots can address in the future needs such as search and rescue, environmental monitoring and emergency response in rapidly unfolding scenarios. Fishes have the ability to evolve in complex and unpredictable environments that may abruptly change. They are capable of maneuvering in ways that can hardly be achieved by present engineering devices. In this sense, the design of such devices can significantly benefit from bioinspired principles.

However, quantitative evaluation of the geometrical and dynamical characteristics of swimming in experiments is challenging [1, 2]. In particular, precise

*Corresponding author
*Email address:* michel.bergmann@inria.fr (Michel Bergmann)
*URL:* http://www.math.u-bordeaux1.fr/~mbergman/ (Michel Bergmann)