Numerical simulation of exploring fish motion by a series of linked rigid bodies

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Present work is mainly based on numerical simulation of solving fish motion problem by using multi-body dynamics algorithm. The fluid solver employs the commercial software ANSYS Fluent 15.0. It is based on finite volume method. Basic theory used in Fluent is by discretising transport equation:

\[
\frac{\partial}{\partial t} \int \rho \, dV + \int \rho \vec{V} \cdot d\vec{A} = \int \nabla \cdot \rho \vec{S} \, dV + \int S_d \, dV
\]

A first order implicit time marching scheme is used for time transient. Second-order upwind scheme is employed for diffusion term discretization. Pressure-velocity coupling can be achieved by the Fractional Step scheme. The first case two-element flapping wing was carried out to check the algorithm accuracy. The second one was about exploring fish motion by given prescribed angular motion.

Results were obtained using ARCHIE-WeSt High Performance Computer (www.archie-west.ac.uk).

This eight-element model is shown in Fig 5. All the elements are identical and the gap between each element is equal as well. Two modes are simulated and Fig 6 gives the path lines for each mode. The angular motion on each hinge is prescribed. Fig 7 and 8 show the contours of two modes at different time. These two modes can stand for two different swimming conditions of fish.

References:
