Title	BCF robotics fish
Author(s)	Ang, Kok Yong
Citation	Ang, K. Y. (2007, March). BCF robotics fish. Presented at Discover URECA @ NTU poster exhibition and competition, Nanyang Technological University, Singapore.
Date	2007
URL	http://hdl.handle.net/10220/9078
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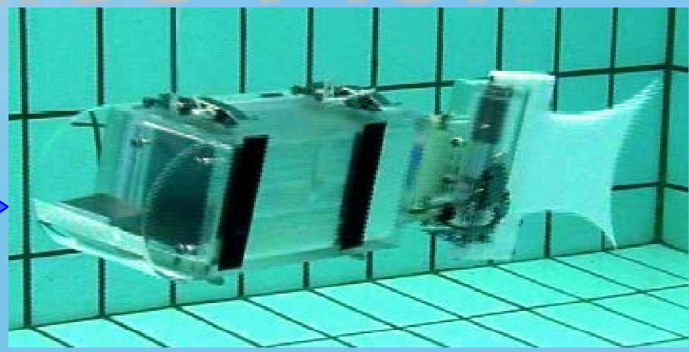
URECA *Undergraduate Research Experience on CAmpus*

Category: 5
Project ID: MAE06205

BCF Robotics Fish

Asian Arowana



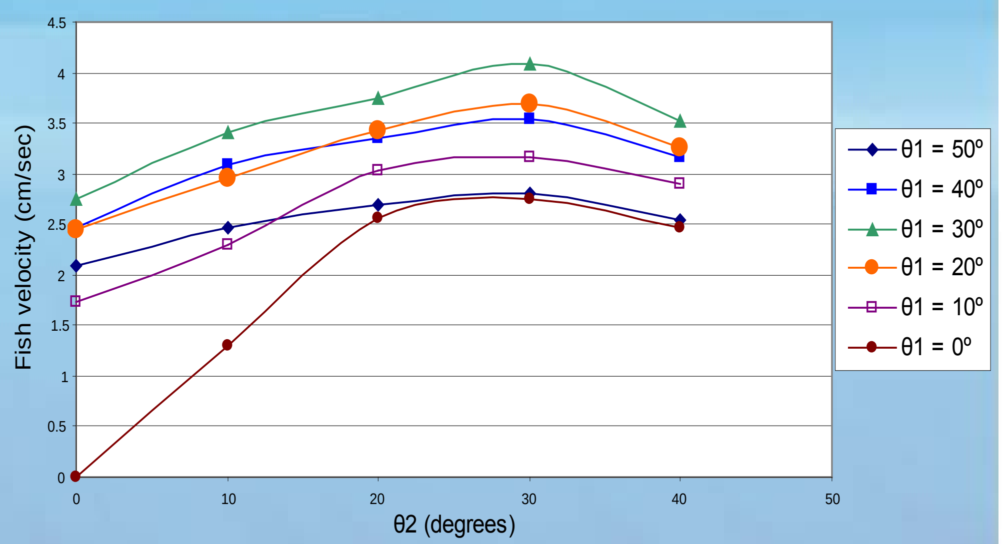
Robotic Fish

Fish Locomotion:

The swimming modes of fish are often termed as **Body and/or Caudal Fin locomotion (BCF)** or **Undulation or Oscillations of Median or Pectoral Fins locomotion (MPF)** based on their physiological mechanics. Under **BCF locomotion**, it has been furthered classified as Anguilliform, **Carangiform**, Thunniform, Subcarangiform, Ostraciiform.

For this **robotic fish**, it mimics the **Carangiform style** where the undulations focus on the **last third of the body muscle mass.** The oscillating caudal fin mechanism engenders the propulsion just as in ***Asian Arowana***. This tail fin module is driven by **two micro DC motors** that provide two degrees of movement.

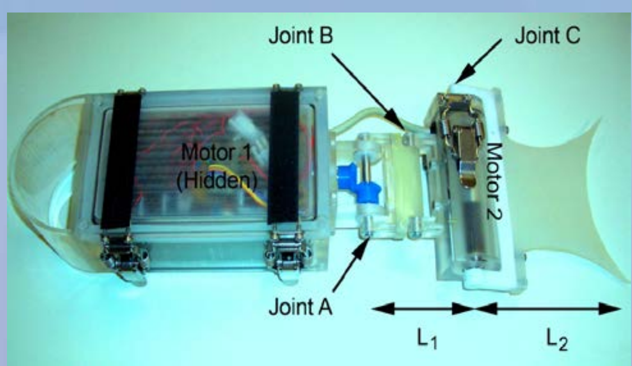
Effects of fish velocity when θ1 and θ2 are varied

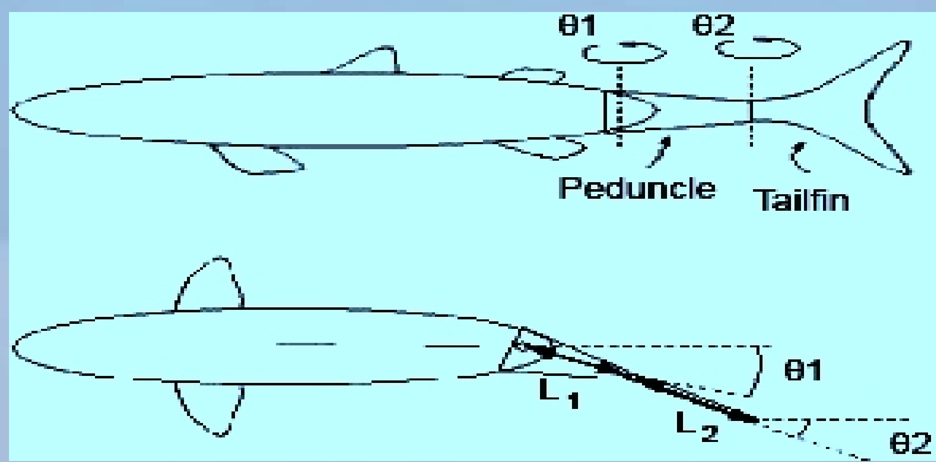


Research Objective and Methods:

Objective: To study and illustrate the relationship between fin angles and BCF robotic fish's swimming velocity.

Method: Using the BasicX programming console to configure the fin angles 1 and 2 by controlling the rotation of motor 1 and motor 2 respectively. Testing was conducted in a water tank measuring 2.5m (length) by 1m (width) by 1m (height).

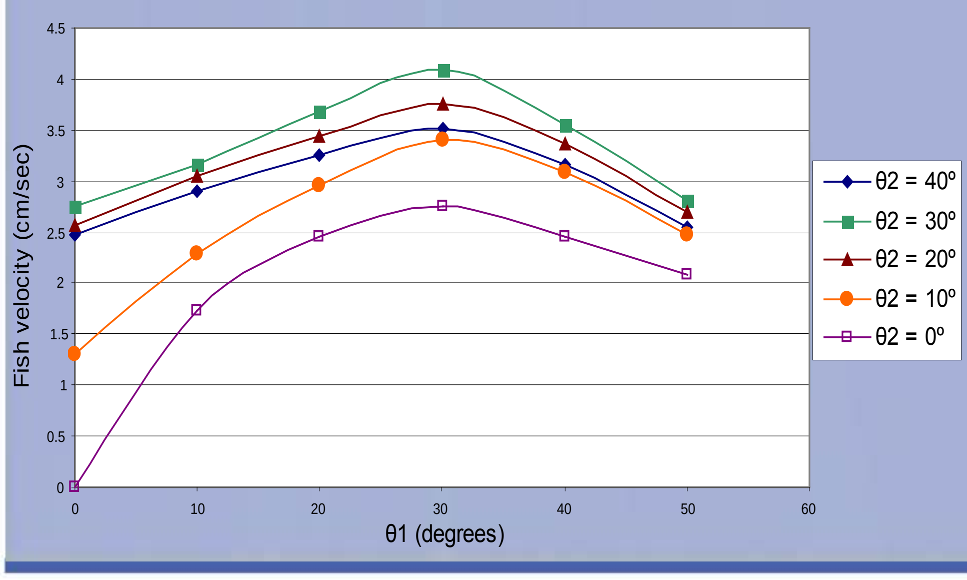




The highest fish's velocity is at 30 degree for both fin angles 1 and 2.

Results Obtained:

Effects of fish velocity when θ1 and θ2 are varied



Conclusion and Suggestions:

Occurrences of rolling and bending of the robotic fish became significant when fin angles are greater than 30 degree.

A recommendation for future improvement will be to shift the motor 2 into the main body and/or use gears or mechanisms to mimic the propulsion gait of the carangiform locomotion. This reduces the bending moment and allows the fish to swim more steadily and effectively.
Another idea is to incorporate buoyancy control device that consists of two air cylinders with pressure control valves. Deflation and inflation of air in the expandable skin of robotic fish act like a gas bladder to facilitate vertical motion.

School of Mechanical and Aerospace Engineering
Project Title: Parametric Studies of Bio-mimetic Robotic Fish
Student: Ang Kok Yong
Supervisor: Associate Professor Low Kin Huat