Unfolding the secrets of godille art

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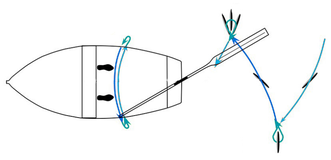
GOAL: Design and build a reduced scale mechanism that reproduce the « eight shaped » godille's motion

REQUIREMENTS:
- The scale of the godille and the resulting motion must respect similarities (Reynolds and Strouhal numbers)
- Modularity: It must be possible and easy to change the motion parameters (amplitude, frequency, angle of attack), in order to conduct experiments
- Waterproof, stable and accurate mechanism

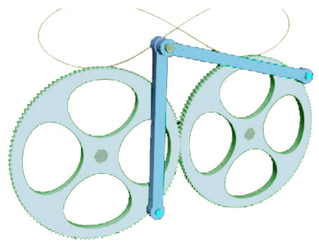
The Godille



The godille is a propulsive and directional oar taking support at the rear end of a boat. The arm movement required to use this oar is similar to an «8». This technique is mainly used in France along the Channel and Atlantic coast, in Brittany but also in China.

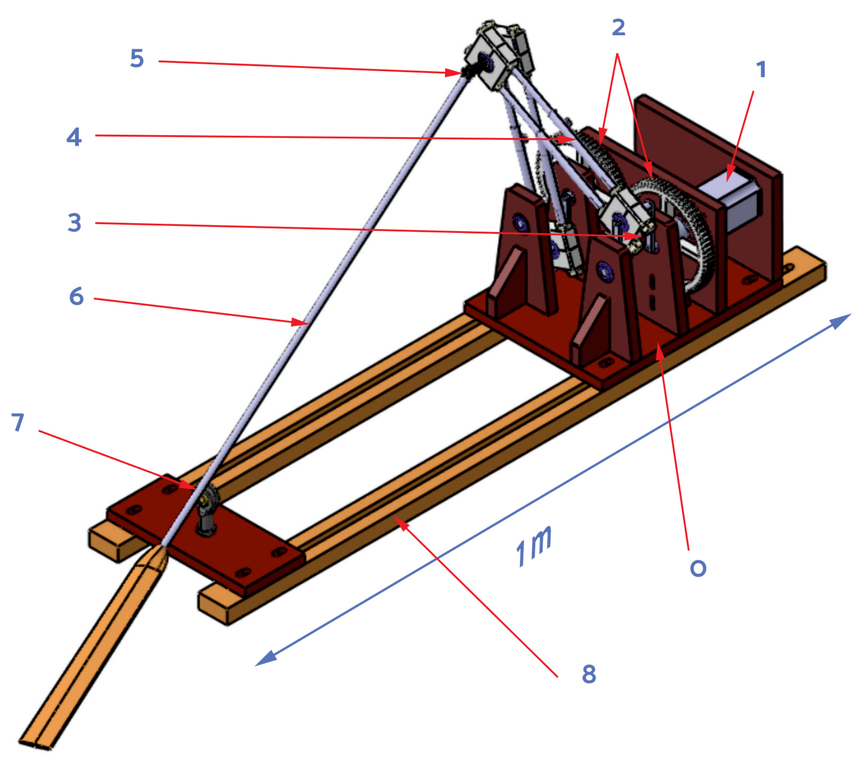
The Mechanism

- One motor and two gears
- Shaft system creating the «8» shape
- 1:3 scaled godille
- Can be implemented in a reduced scale boat or water channel for experiments



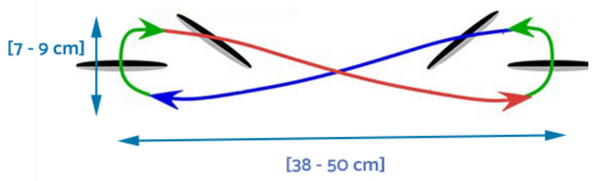
Structure

The motor (1) is linked to a 1st gear (2) by a 3D printed transmission. The two gears actuate the two crank shafts attached to the adjustable arms (4). The two arms are linked at one end by the first ball joint (5) and transmit the motion to the godille's handle (6). The handle is constrained at (7) by a second ball joint. The angle of attack is adjustable with notches in an aluminium tube. The built is fixed on rails (8), allowing the mechanism to slide and change the entry angle of the blade in the water.



Modularity

- Frequency: adjustable by Arduino (0-2Hz)
- Amplitude of the motion: 38 to 50 cm
- Angle of attack: adjustable notches (0-20°)
- Entry angle of the godille in the water



Flow analysis and calculations

Similarities:

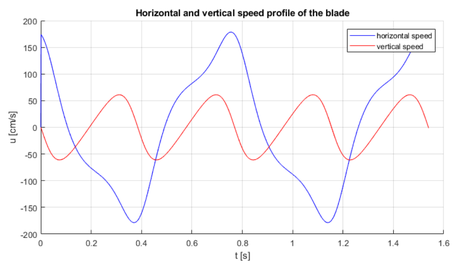
$$St = \frac{f.L}{U} \; ; \; Re = \frac{\rho.U.L}{\mu}$$

- Studied 1:1 scale motion: Amplitude: 0.8 m, Frequency: 1 Hz
- Corresponding 1:3 motion: Amplitude: 0.5 m, Frequency: 1.3 Hz
- Maximum force on the blade: 40 N

Modeling of the performance

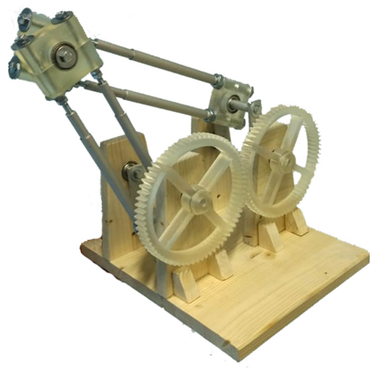
Estimation of load and performance along the «8».
For a frequency of 1.3 Hz, an amplitude of 0.5 m and an angle of attack of 20°:

- Maximum torque needed: 15 N.m



Further developments

- Add and program a motor for the angle of attack control
- Implement the mechanism in a boat or water channel
- Add load sensors



Conclusion

- Main goals reached
- Development and construct of an innovative mechanism
- Great team work

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