

Vortex structures in the wake of a sphere rotating in streamwise direction

A 12-credit-point Final Year Project for one student studying Mechanical or Aerospace Engineering
Supervisors:

Prof Mark Thompson

☎ +61 3 9905 9645

✉ mark.thompson@monash.edu

Dr Jisheng Zhao

☎ +61 3 9905 1615

✉ jisheng.zhao@monash.edu

Background

Rotating spheres find applications not only in sports, where spinning balls are known to change trajectories, but also in particle and blood flows, external ballistics, engine combustion and chemical processing where the transfer of heat, mass and momentum is affected by the flow past particles/droplets undergoing both translation and rotational motion.

In general, the particle/droplet rotation axis can be aligned in any direction relative to the incoming flow and the dynamics of the wake structures change accordingly. This project aims to better understand the vortex structures in the wake of a rotating sphere when the axis of rotation is parallel to the incoming flow.

Project description

In this experimental project, it is required to design and implement an experimental model to an existing rig (shown in Figure 2) for stream-wise rotation of a sphere. The experiments will be conducted in the Water Channel Laboratory of FLAIR (www.flair.monash.edu.au). The particle image velocimetry (PIV) technique will be undertaken to analyse the vortex structures in the sphere's wake. The dynamics and evolution of the vortices will be characterised with rotational speed variation.

Student requirements

This project will suit 1-2 students that have a strong understanding of fluid mechanics, competency with MATLAB, and basics of signal processing. The project will be 12 credit points.

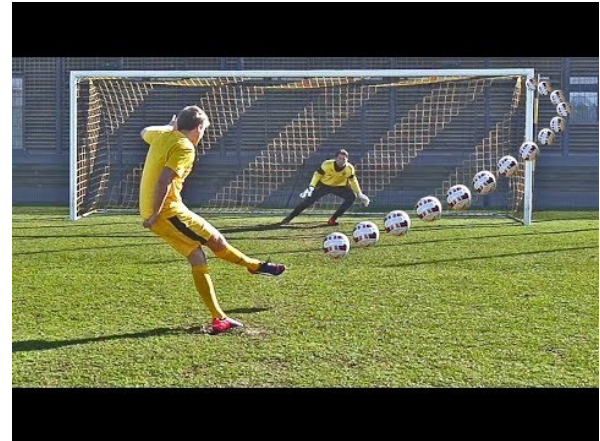


Figure 1: A picture showing change in trajectory of a football due to rotation. Such effects are well evident in 'Banana kicks' in football.

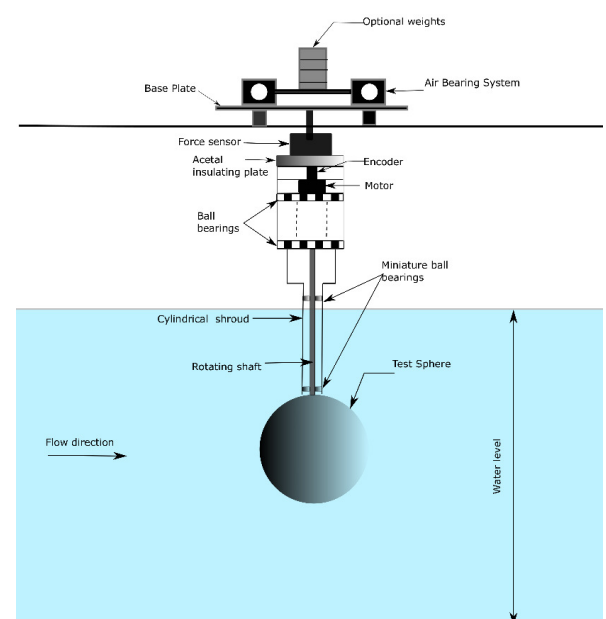


Figure 2: Experimental rig to study rotating sphere