

# Project Outlines 2012

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# **1 Projects suitable for Masters Students (by Research)**

## **1.1 Numerical study of Flow over a bluff body with a downstream body**

Flow over a bluff body is the fundamental aspect in the understanding the physics of flow for more complex geometries. The evolution of Kármán Vortex is responsible for the generations of fluctuating forces and prominent aeolian tone. This study is to numerically analyse the effects of downstream body on the instability of the wake. The findings of the study can be applied for side rear view mirrors of passenger cars, bridge piers, offshore oil platform cylinders and etc.

## **1.2 Numerical study of a passive noise control using a flat plate for bluff body applications**

The dipole noise radiating from flow over a cylinder can be cancelled out theoretically by placing a flat plate downstream of the body. However, the plate can change the instability of the wake. This study is to investigate the possibility of using a flat plate for passive noise control by changing the position and geometry of the plate. Side view mirror of passenger cars, landing gear system of aircraft and pantograph system of high speed train can benefit from this study.

## **1.3 Aerodynamics loading and Noise emissions from a high speed train**

When trains moving at high speed, the aerodynamics and airborne noise become a significant concern, that is very similar to the aircrafts. A study on the various shapes of high speed train on the characteristics of aerodynamics loading and airborne noise is beneficial in the design process of a high speed train. This is in-line with the National Key Area: Greater Kuala Lumpur, that proposes a high speed train moving at 250 to 450 kmph connecting Singapore and Kuala Lumpur.

## **1.4 Airborne noise due to buffeting flow over a high-rise building**

During an extreme wind condition, turbulence flow carries by the wind may interacting with building's structure that then radiating a significant noise level. This study is to investigate the effect of boundary layer that suits to the Malaysia terrain on the airborne noise radiation for a typical Malaysia's high rise buildings. This study may involve outside or real wind speed mappings and sound measurements.

## **2 Projects suitable for Ph.D Students**

### **2.1 Passive Noise and wake control of flow over a protruding cylinder**

When flow past a truncated cylinder a very complex flow structure is generated. This study requires detailed investigation on the generation of four main structures, i.e., horseshoe vortex, tip free shear layer, sides free shear layers and trailing vortices. How these flow structures influence the generation of noise is also will be investigated thoroughly. After the full investigation of the single protruding cylinder, a rigid flat plate is placed downstream of the cylinder. The geometry and location of the plate may varies to see the effect of these parameters on wake and noise generations. Numerical simulation is necessary and experimental work requires collobration with other universties.

### **2.2 Flow and noise associate with a vortex-fluttering plate interaction**

A periodic vortex with strong energy is generated when flow past a bluff body above its critical Reynolds number,  $Re_c \sim 50$ . This energy may be extracted to generate a renewable energy by wind induced motion mechanisms. One of the possibility is by placing a moveable flat plate downstream of the cylinder. However, the vortex-plate interaction may create fluctuations of aerodynamics loadings and radiating noise. This study intends to investigate the effects of vortex-fluttering downstream plate on the flow structure and noise radiation. The fluttering properties of the plate may varies ac-

depending on the spring stiffness, damping ratio, plate geometry and mass of the plate. Again, numerical simulation is compulsory and experimental work requires collaboration with other universities.