last update on the 15th of February 2010
- one more announcement added (Σ13)

MAJOR PROJECT
BMEGEÁTMWD1

Mechanical Engineering Modelling MSc

Major Project Announcements

2009-2010-II semester

Please contact the supervisor on the 1st week!

website:

http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATMWD1/

1. *Supervisor(s):* **Tamás RÉGERT and Tamás LAJOS** *Title:* **Experimental and numerical investigation of flow control possibilities to prevent wind induced flattering of large-span bridges** *Description:* The project consists of wind tunnel experiments and computational fluid dynamics simulations.

2. *Supervisor(s):* **Tamás LAJOS and Márton BALCZÓ** *Title:* **Wind tunnel modelling and numerical simulation of dispersion of traffic related pollutant induced by wind and influenced by tall buildings** *Description:* Subject of investigation are both downflow of less polluted air close to the building wall facing the wind and upflow of polluted air in the separation bubble.

3. *Supervisor(s):* **Jenő Miklós SUDA** *Title:* **Experimental and numerical investigation on influence of the upstream flow condition on the signal of the air flow meter sensor** *Description:* In course of the project the air flow condition in the air intake unit and its influence on the MAF signal is to be analysed both numerically and experimentally. Air intake unit of a car usually consists of several elements that may gain influence on the flow condition upstream to the air flow meter (AFM). These elements are e.g. the inlet cone, tubing, filter housing with air filter element and connection piece or guide vanes in the filter housing upstream of the air flow meter unit. The flow condition upstream of the sensor may gain influence on the signal that is proportional to the mass flow rate. Deviation of the signal due to the flow condition is crucial while the AFM is used (in connection with lambda sensor signal and butterfly valve position signal) to regulate fuel-injection to fulfil the strict exhaust-gas requirements. Wrong or modified MAF sensor signal due to the changed upstream flow condition can cause shift between the real and the measured air mass flow rate, hence, the digital motor electronic (DME) system is regulating based on wrong signal.

4.
Supervisor(s): **Viktor SZENTE**
Title: **Development of a Laval-nozzle measurement bench**
Description:
The task is to assemble a measurement bench with which Laval nozzles can be measured. It is possible to use the results of previous experiments and researches. The aim of the task is to create a computer-controlled measurement system, which is capable of measuring the thrust of the nozzles, and, if possible, to visualize the flow exiting from the nozzle.

5. *Supervisor(s):* **Viktor SZENTE** *Title:* **Development of a pneumatic measurement bench** *Description:* Electro-pneumatic valves are widely applied in several areas of industry. The knowledge on the flow characteristics of such valves is especially important in the cases when they are integrated in fast-response fluid power systems as control devices. The aim of the task is to develop a computer-controlled measurement bench with which the transfer characteristics of such valves can be measured even by students with relative ease. It is possible to use the results of previous experiments and researches.

6. *Supervisor(s):* **Viktor SZENTE** *Title:* **Development of a pneumatic distribution system** *Description:* Pressurized air has a number of uses in fluid mechanics. To provide easy access, the Department plans to build a pipe system to distribute compressed air into different areas of the main lab. The task is to develop this system, with special attention on the appropriate placement of the large reservoir and the loud compressor. It is possible to use the results of previous researches.

7.

Supervisor(s): **Jenő Miklós SUDA**

Title: **Development of flow visualisation system**

Description:

In course of flow visualisation projects we are often facing the crucial problem "*how to produce uniform distributed tracers of the seeding particles*" and also "*how to transport the seeding to the flow phenomena to be visualised in the tubing without settling*". The task is to design and test a new unit that is capable to solve such problems of the flow visualisation. Fog generator with fog fluid are available, anything else is to be newly designed and tested.

8. *Supervisor(s):* **János VAD**, *assistant supervisor*: **Csaba HORVÁTH** *Title:* **Modelling of airflow generated by az axial motor cooling fan** *Description:* The project aims at modelling the flow developing in the blade passages as well as in the surroundings (inlet perforated cover, motor shield) of a recently developed axial flow fan to be used for cooling of electric motors. The modelling is based on Computational Fluid Dynamics (CFD), and therefore, firm background knowledge and practical skill in CFD is a prerequisite. The CFD results are to be validated to experimental data available at the Department. The evaluation of the simulation results provides guidelines for refinement of the fan geometry, for performance and efficiency gain, with consideration of radial velocity and apparent separation zones.

9. *Supervisor(s):* **Máté Márton LOHÁSZ** *Title:* **Vortex tracking in a low Re cylindrical jet flow** *Description:* A BSc thesis was carried out to investigate the usability of the vortex tracking algorithm developed at the department for the investigation of a asymmetrical 2D jet flow. The algorithm was able to qualitatively highlight the features of vortex roll-up and subsequent merging. However, some problems were found in the quantifications. In the presently proposed project the tracking code has to be understood in detail to enable possible improvements. In a second step the method has to be tested in a similar case of 3D jet flow, with slight azimuthal disturbance. The proposed software is: IcemCFD and Fluent

10. *Supervisor(s):* **Máté Márton LOHÁSZ** *Title:* **Investigation the LES of channel flow using OpenFOAM** *Description:* The open-source software OpenFOAM contains an easily usable "solver" suited for channel flow Large Eddy Simulation, also including a script to post-process the results. In the thesis the available code has to be used for the investigation of the Large-Eddy Simulation including: Mesh dependency, numerical scheme dependency, Sub-Grid-Scale model dependency.

11.

Supervisor(s): **László NAGY**

Title: **Domain reduction in RANS/LES computations**

Description:

Laminar and Reynolds averaged computations are to be carried out in the vicinity of airfoil using the SST k-omega, realizable k-epsilon turbulence model in 2D. The airfoil to be investigated is a RAF6-E profile at an incidence of 5° and at chord (c) Reynolds number at 122 000. The computations are to conducted in a zonal domain of 1.1c x 0.5c in streamwise and wall-normal direction. The domain is to be cut at 60% of suction side of airfoil. These domain reduction effects are to be investigated in course of this project, especially in the boundary conditions of the outlet and the wall-normal direction. The method for numerical simulation is an incompressible implicit second-order finite volume method with a collocated grid arrangement employed by ANSYS-FLUENT v12 commercial code. The behaviour of turbulence flow in vicinity of airfoil is to be compared to previously calculated Large-Eddy Simulation in the domain of 3c x 1c based on velocity profiles and integral parameters.

12. *Supervisor(s):* **János VAD**, *assistant supervisor*: **Csaba HORVÁTH** *Title:* **Investigation of the off-design characteristics of axial flow fans with circumferential forward skew** *Description:* In the ongoing research of axial flow fans of controlled vortex design, the Department of Fluid Mechanics has made great progress in understanding the aerodynamic and acoustic characteristics of circumferentially forward skewed rotor blades in the design point. This research is being continued in order to better understand the effects of circumferential forward skew in different off-design conditions, with Computational Fluid Dynamic (CFD) simulations being used in order to accomplish this. After successfully overcoming the obstacles associated with simulating a rotor in an off-design work point, the results will be validated against measurement data. These results will then be investigated in order to learn more about the aerodynamic and acoustic characteristics of these fans. In partaking in this project one can learn a great deal about rotor blade design, CFD simulations, CFD result validation using measurement results, and the aerodynamic and acoustic characteristics of axial flow fans.

13.

Supervisor(s): **Gergely KRISTÓF**

Title: **Thermo-hydraulic simulation of a controlled solar frontage**

Student: **Hercz Zoltán**

Description:

Summertime, the controlled solar frontage is used to absorb most of the solar energy, thus decreasing the energy consumption of the air-conditioning system, furthermore provides full control over the natural illumination. Wintertime, the same system can collect solar energy for heating glass covered winter gardens at the elevated floor levels.

On building side of the solar frontage there is window of high thermal insulation characteristics. At a given distance from the window side a single layer of glass is placed. The solar energy is absorbed by a layer of shutters existing between the windows and the decorative glass. These shutters are cooled by the controlled natural convection (chimney draught) of the solar frontage.

Tasks:

1. Literature research on the thermo-hydraulic simulation of glass houses with special respect to modelling methodologies of the radiation heat transport;
2. Preparation of a lumped parameter model based on the empirical formula for the surface heat transfer coefficient;
3. Preparation of the parametric geometrical model of the solar frontage and generation of a suitable mesh;
4. To set-up the CFD model in ANSYS FLUENT system by taking into account the radiation heat transfer;
5. Comparison of the resultant surface heat transfer coefficient by empirical formula.
6. Calculation of summer maxima of air temperature within the solar frontage for cases of various building orientations, shutter angles, geometrical parameters and different hydraulic characteristics of the air outlet;
7. Preparation of a written report.