MSC PROJECT: Simulation of the flow around a simplified truck using Active Flow Control (AFC)

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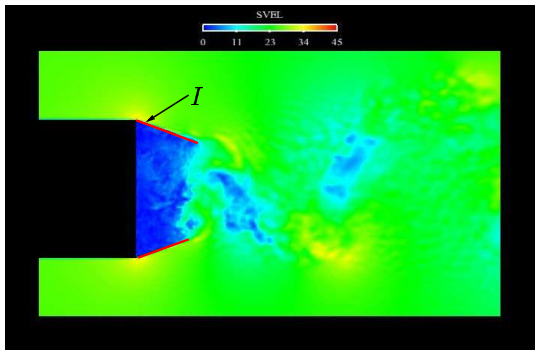
Background: The larger part of the drag for trucks is created by the wake which gives a low pressure at the rear of the truck. An effective way to reduce the drag (and thus the fuel consumption and CO2 emissions) is to increase the pressure at the rear side of the truck. This pressure increase can be achieved by reducing the size of the wake and/or the vortex shedding of the wake behind the truck.

At the Department we have an on-going PhD project (PhD student Mohammad El-Alti) together with Volvo Trucks where we study how to reduce the drag by active flow control (AFC). Injectors are used. They are placed in the rear region of the truck and give a pulsating jet. Large Eddy Simulations are used to find suitable location and properties of the injectors. We need to know how large the amplitude of the pulsating jets should be, what frequency, the angle between the jet and wall etc. The commercial software STAR-CD is used.



In the figure above the rear part of a simplified truck is shown. Flaps have been added (marked in red) and at the beginning of the flaps, the pulsating jets (marked with an I) are located. The figure shows the instantaneous velocity field (green: high velocity; blue: low velocity).

Master project: In the MSc project we will use an in-house FEM code developed by Per Kjellgren. This code has been used extensively by Per using ACF to obtain increased lift capability of rotor aircrafts such a the Boeing/Bell V-22 and the NASA's experimental aircraft XV-15.

In the project the flow presented in the figure above will be simulated. The aim of the MSc project is to evaluate the efficiency of the FEM code compared to the STAR-CD code. The same mesh will be used.

Time plan: The project is suitable for one or two MSc students. The work should be carried out at the Division of Fluid Dynamics starting in spring or early autumn 2008. For more information, please contact Lars Davidson (lada@chalmers.se).