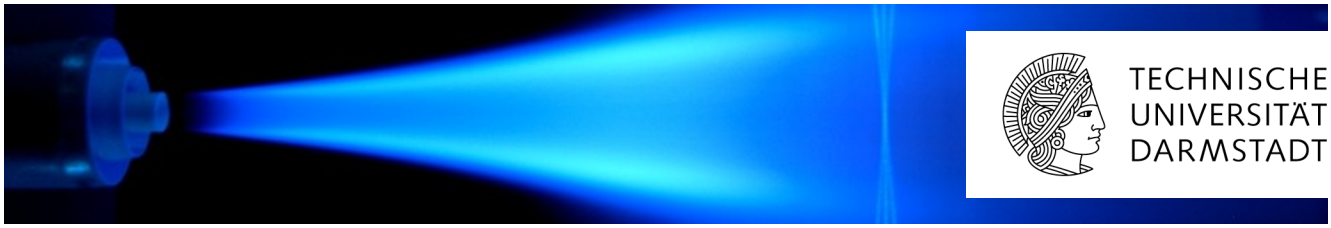


TECHNISCHE UNIVERSITÄT DARMSTADT

Master Thesis/Bachelor Thesis

Topic : Large Eddy Simulation of cooling of hot spherical disk with impinging nitrogen jet

Institut für Energie- und Kraftwerkstechnik

Prof. Dr.-Ing. Johannes Janicka

Petersenstraße 30
64287 Darmstadt

Tel. +49 6151 16 - 2157
Fax +49 6151 16 - 6555
janicka@ekt.tu-darmstadt.de

Datum
19.06.2012

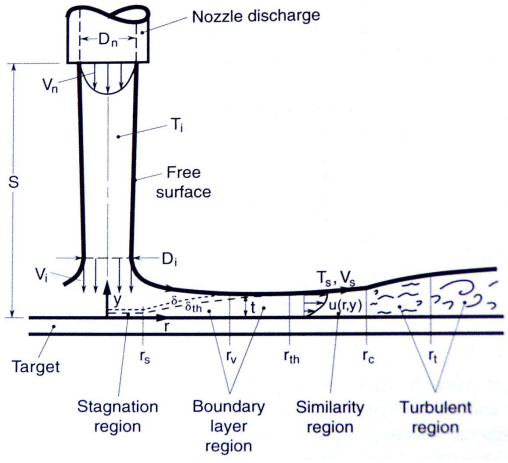
Impinging jets provide an effective and flexible way to transfer energy or mass in industrial applications and it is associated with other phenomenon in some applications like **IC engines**. A directed liquid or gaseous flow released against a surface can efficiently transfer large amounts of thermal energy or mass between the surface and the fluid. Heat transfer applications include cooling of engines in automobiles, cooling of stock material during material forming processes, heat treatment, cooling of **electronic components**, heating of optical surfaces for defogging, cooling of **turbine components**, cooling of critical machinery structures, and many other industrial processes. Typical mass transfer applications include **drying** and removal of small surface particulates. Abrasion and heat transfer by impingement are also studied as side effects of vertical/short take-off and landing jet devices, for example in the case of direct lift propulsion systems in **vertical/short take-off and landing aircraft**. Also when fuel is sprayed in the **combustion chamber of a reciprocating internal combustion engine, the resulting flow impinging on the cylinder wall presents jet like features**. The flow of a submerged impinging jet passes through several distinct regions, as shown in figure. The jet emerges from a nozzle or opening with a velocity and temperature profile and turbulence characteristics dependent upon the upstream flow. For a pipe-shaped nozzle, also called a tube nozzle or cylindrical nozzle, the flow develops into the parabolic velocity profile common to pipe flow plus a moderate amount of turbulence developed upstream. The numerical modeling (CFD) is seen as an effective tool in understanding the complex flow and thermal problems in various applications. Here the main focus of the study is to develop CFD based numerical method to capture more accurate flow and thermal boundaries near the wall and analysing them in detail. In this work the turbulent nitrogen jet impinging on the hot spherical disk will be simulated using LES based CFD code, and heat and flow behaviours near the impinging wall will compared against the experimental data.

Requirements:

1. **Good knowledge on Flow, Mass and Heat transfer and turbulence**
2. **Attending the CFD modeling Courses**
3. Interest in programming language (FORTRAN)

Responsibilities:

- Carry out Large Eddy Simulations of Impinging jets on hot walls using FASTEST-3D CFD code
- Detailed analysis of flow and heat transfer near the wall
- Study of mesh sensitivity on numerical prediction in near wall regions



Begin : July 2012-Sep 2012

Pradeep Pantangi, M.Sc.
Institut für Energie- und Kraftwerkstechnik
Tel. +49 6151 16 - 2533
Raum L1/01 285
pantangi@ekt.tu-darmstadt.de