PhD Advert Template

Project title: Investigation of convective and conjugate heat transfer for different jet configurations using Direct Numerical Simulations

Project ID *(optional)*: *Please leave blank*

Accept all year-round applications

Funding information: Self-funded students only

Project description: In this project, we propose to conduct Direct Numerical Simulation (DNS) of hot jets in turbulent flows, including channel cross flow at different friction Reynolds numbers and impinging jets, using different thermal wall boundary conditions along with conjugate heat transfer (CHT) wall boundary condition. The hot jet configuration is representative of heat transfer problems encountered in gas turbine cooling applications, nuclear powerplants as well as heat transfer process involved in electric motor cooling. In the recent past several DNS studies of a hot jet in channel cross flow have been performed, but the friction Reynolds number has been low. Furthermore, in those studies no variation of the wall temperature have been investigated. This raises the question on the generality of the temperature variance and scalar dissipation rate statistics obtained from those calculation. In this spirit, we propose to do a parameter sweep on the wall temperature for isothermal and CHT boundary conditions for different jet flow configurations. This will enable us to investigate the limiting cases under no heat loss conditions (i.e. adiabatic walls) and complete heat loss (i.e. isothermal walls). Whereas, the more real scenario will be represented by CHT wall boundary condition. These simulations will provide data for developing Reynolds Averaged Navier-Stokes (RANS) and Large Eddy Simulations (LES) models, which are useful in industrial calculations of heat transfer processes. This DNS data will be explicitly Reynolds averaged/ LES filtered to assess the performances of existing models with respect to the corresponding quantities extracted from DNS data. Based on this a-priori DNS analysis modifications to the existing models will be suggested and new models will be proposed wherever necessary.

The industrial partners will be kept involved during this project and they will attend the progress review meetings. We expect to publish project outcomes in reputed journals (eg Physics of Fluids, Journal of Fluid Mechanics, Physical Review Fluids, International Journal of Heat and Mass Transfer) and conference proceedings (eg Engineering Turbulence Modelling and Measurement, Turbulent Shear Flow Phenomena, Turbulent Heat and Mass Transfer). The student will also have the opportunity to work with Turbulence and Heat transfer groups at the University of Manchester, Imperial College London, as well as reputed Turbulence researchers in the Germany and Japan.

The applicant for this project is expected to have a 1st class or 2:1 degree in Aerospace, Mechanical and Chemical Engineering, Applied Mathematics, or Applied Physics.

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Application enquires: *Dr. UMAIR AHMED, Email:* [*Umair.Ahmed@newcastle.ac.uk*](mailto:Umair.Ahmed@newcastle.ac.uk) *weblink:* [*https://www.ncl.ac.uk/engineering/staff/profile/umairahmed.htmlv*](https://www.ncl.ac.uk/engineering/staff/profile/umairahmed.htmlv)

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drama

fashion

film studies

fine art

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music

music technology

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biomedical engineering

chemical engineering

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control systems

cybernetics

dynamics

electrical engineering

electronic engineering

energy technologies

environmental engineering

fluid mechanics

gas engineering

geotechnical engineering

integrated engineering

manufacturing engineering

marine engineering

mechanical engineering

mechanics

mechatronics

nanotechnology

offshore engineering

petroleum engineering

robotics

solid mechanics

structural engineering

structural mechanics

systems engineering

thermodynamics

other

Environmental Sciences

climate science

hydrology

marine sciences

meteorology

pollution

soil science

other

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actuarial science

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investment

taxation

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political geography

remote sensing

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geotechnology

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marine geology

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seismology

volcanology

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american history

ancient history

archaeology

asian history

australasian history

british and irish history

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european history

heritage studies

history

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history of religions

history of science

medieval history

military history

modern history

russian history

social history

world history

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information systems

librarianship

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american studies

asian studies

australasian studies

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danish

dutch

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english literature

european studies

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french

german

italian

japanese

middle eastern studies

norwegian

portuguese

russian

spanish

swedish

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Law

criminal law

commercial law

contract law

property law

other

Linguistics & Classics

ancient greek

celtic studies

classics

latin

linguistics

other

Materials Science

ceramics

glass

metallurgy

polymers

textiles

other

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computational mathematics

data analysis

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probability

pure mathematics

statistics

stochastic processes

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anatomy

audiology

biomechanics

cardiology

complementary medicine

dentistry

endocrinology

epidemiology

neural engineering

neurology

nutrition

ophthalmology

optometry

pathology

pharmacology

pharmacy

physiology

physiotherapy

podiatry

radiology

speech science

tissue engineering

toxicology

other

Nursing & Health

adult nursing

community nursing

counselling

dental nursing

environmental health

health informatics

medical nursing

mental health nursing

midwifery

occupational health

occupational therapy

paediatric nursing

paramedical science

surgical nursing

other

Philosophy

ethics

metaphysics

philosophy of science

other

Physics

acoustics

astronomy

astrophysics

chemical physics

computational physics

electromagnetism

environmental physics

experimental physics

medical physics

nuclear physics

optical physics

particle physics

quantum mechanics

solid state physics

space science

theoretical physics

other

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development studies

government

international relations

politics

public policy

other

Psychology

child psychology

clinical psychology

community psychology

counselling psychology

developmental psychology

educational psychology

forensic psychology

health psychology

neuropsychology

occupational psychology

organisational psychology

psychotherapy

sport psychology

other

Sociology

criminology

disability studies

gender studies

socio economics

social work

other

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sport coaching

sport development

sport performance

sport technology

sport therapy

other

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divinity

religious studies

theology

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veterinary nutrition

veterinary pathology

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