

# **NAQAVI, IFTEKHAR ZAHEER**

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## **EDUCATION:**

**Ph.D.**, Mechanical Engineering, (2002-2007)

The University of Western Ontario, London, Ontario, Canada.

COURSES: Exper. Meas. in Fluid Mech., Adv. Computational Fluid Dynamics, Continuum Mechanics for Engr., Adv. Numerical Analysis AM562b, Astrophysical Gas Dynamics, Mechanism and Theory of Turbulent Flow, Special Topics (Direct Numerical Simulation of Navier-Stokes Eq.), Adv. Numerical Analysis AM561a, Solution of PDE's AM566a, Hydrodynamic Stability, Princ. and App. of Neural Network. (*Secured 88.7% marks overall*)

**M.S.**, Mechanical Engineering, (2001)

King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia.

COURSES: Mathematical Methods, Adv. Fluid Mechanics I, Continuum Mechanics, Conduction Heat Transfer, Numerical Methods in ME, Radiation Heat Transfer, Finite Element in Mechanical Design, Advanced Material Science. *GPA 3.8/4.0.*

**B.E.**, Mechanical Engineering, (1998)

NED University of Engineering and Technology, Karachi, Pakistan.

(*Secured 83% marks with a 3<sup>rd</sup> merit position in a group of 230 students.*)

## **RESEARCH INTERESTS:**

Direct Numerical Simulation and Large Eddy Simulation of Turbulent Flows, Parallel Programming and Computations, Numerical Techniques, Compressible and Incompressible Flows, Laser Material Interaction.

## **RESEARCH EXPERIENCE:**

**The University of Western Ontario**

*Advisors:* Dr. Eric Savory, Dr. Robert J. Martinuzzi

*Thesis Title:* 'Direct numerical simulation of a rectangular surface jet.'

**King Fahd University:**

*Advisors:* Dr. B.S. Yilbas, Dr. Ibrahim Dincer, Dr. Shahzada Zaman Shuja

*Thesis Title:* ‘Conduction and non-conduction limited laser heating process-Mathematical simulation.’

**N.E.D. University of Engg. and Tech:**

*Advisor:* Dr. Nazim Qureshi

*Thesis Title:* ‘Design of a machine for rapid prototyping.’

**TEACHING EXPERIENCE:****The University of Western Ontario**

Teaching Assistant (T.A.) MME385y ‘Selected experiments in Mechanical Engineering’ (2002-2006)

**N.E.D. University of Engg. and Tech:**

I have taught courses of Thermodynamics and Gas Turbine Laboratory as part-time lecturer before joining M.S. (1998-1999)

**COMPUTING SKILLS:**

Worked extensively in developing codes in FORTRAN.

Have used MPI, PETSc.

Have also used C++, MATLAB, MATHEMATICA, Tecplot, Surfer, Ansys, AutoCAD, FLUENT.

Have also worked on Windows and Unix.

**CODE DEVELOPMENT:**

1. **PHASECh2D:** This code was developed during my MS, which solves heat transfer problems involving the phase change from solid to liquid and liquid to gas. It involves tracking of the moving phase fronts. Results from this code were presented in several publications.
2. **DNSCh3D:** This is a direct numerical simulation (DNS) code for three-dimensional turbulent flow in a channel. It solves velocity-vorticity form of Navier-Stokes equation using a pseudo-spectral scheme with compact finite difference discretization.
3. **3DLES:** This is a large eddy simulation (LES) code to solve three-dimensional turbulent flows. It uses second order finite difference discretization on a staggered grid to solve Navier-Stokes equation in primitive variable using a fractional-step scheme. Immersed boundary techniques are also incorporated in this code to tackle complex geometries. Few examples from this code are available on my web page in form of animations.
4. **ParLES:** This is a parallel DNS/LES code for three-dimensional turbulent flow based on Single Program Multiple Data (SPMD) paradigm. It uses second order finite difference discretization on a collocated grid to solve Navier-Stokes equation using fractional-step scheme. Parallelization is achieved through MPI and PETSc is used to solve resulting system of equations. This code has been

thoroughly validated using up to 32 processors of 'silky', an SMP machine on SHARCNET.

## **PUBLICATIONS:**

1. Yilbas BS and **Naqvai IZ**, 'Laser heating and thermal stresses time exponentially heating pulse case.' *Transactions of the Canadian Society for Mechanical Engineering*, **30**(1): 113-142 (2206).
2. Yilbas BS, Khan O and **Naqvai IZ**, 'Laser pulse heating and thermal stress developments: elastoplastic analysis.' *Proceedings of the Institution of Mechanical Engineers Part B – Journal of Engineering Manufacture*, **218**(4): 375-388 (2004).
3. **Naqvai IZ**, Yilbas BS and Khan O, 'Laser heating of multiplayer assembly and stress levels: elasto-plastic considerations.' *Heat and Mass Transfer*, **40**(1-2): 25-32 (2003).
4. Yilbas BS and **Naqvai IZ**, 'Laser heating including phase change process and thermal stress generation in relation to drilling.' *Proceedings of the Institution of Mechanical Engineers Part B – Journal of Engineering Manufacture*, **217**(7): 977-991 (2003).
5. Yilbas BS, **Naqvai IZ** and Shuja SZ, 'Modelling and experimental study into the laser assisted nitriding of Ti-6Al-4V alloy.' *Journal of Manufacturing Science and Engineering – Transaction of the ASME*, **124**(4): 863-874 (2002).
6. **Naqvai IZ** and Yilbas BS, 'Laser nanosecond pulse heating of surfaces and thermal stresses.' *Numerical Heat Transfer Part A – Applications*, **40**(3): 295-316 (2001).
7. **Naqvai IZ**, Savory E and Martinuzzi RJ, 'A numerical study of a horizontal rectangular surface jet.' (*Submitted to Int. J. Heat and Fluid Flow*)
8. **Naqvai IZ**, Savory E, Martinuzzi RJ and Gurka R, 'Direct numerical simulation of a horizontal rectangular surface jet. Part 1. The jet structure.' (*Submitted to Physics of Fluids*).
9. **Naqvai IZ**, Savory E, Martinuzzi RJ and Gurka R, 'Direct numerical simulation of a horizontal rectangular surface jet. Part 2. The origin of surface current.' (*Submitted to Physics of Fluids*).
10. **Naqvai IZ**, Savory E, Martinuzzi RJ and Gurka R, 'The turbulent properties of a rectangular surface jet via direct numerical simulation.' (*Submitted to J. of Turbulence*).
11. **Naqvai IZ**, Savory E and Martinuzzi RJ, 'Flow characterization of inclined jet in cross flow for thin film cooling via Large Eddy Simulation.' *Canadian Society for Mechanical Engineering Forum*, 21-24 May 2006, Kananaskis, Canada.
12. **Naqvai IZ**, Savory E and Martinuzzi RJ, 'A numerical investigation of laser heating including the phase change process in relation to laser drilling.' *Canadian Society for Mechanical Engineering Forum*, 1-4 June 2004, London, Canada.

## AWARDS and HONORS:

- Have received President's Scholarship for Graduate Studies (PSGS) from the University of Western Ontario. (2002-2003)
- Have received International Graduate Student Scholarship (IGSS) from the University of Western Ontario. (2002-)
- Have been awarded Ontario Graduate Scholarship (OGS). (2004-2005)
- Chancellor's Doctoral Fellowship, University of Nebraska, Lincoln. (Didn't avail)
- Research funding for a NASA Project, University of Connecticut, Storrs. (Didn't avail)

## REFERENCES:

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| <p><b>Dr. Eric Savory</b><br/>Associate Professor<br/>Department of Mechanical and Materials Engineering,<br/>The University of Western Ontario<br/>London, Ontario, Canada. N6A 5B9<br/><b>Email: esavory@eng.uwo.ca</b><br/>(519) 661-2111 ext. 88256</p> | <p><b>Dr. Robert J. Martinuzzi</b><br/>Professor<br/>Department of Mechanical and Manufacturing Engineering, Faculty of Engineering,<br/>University of Calgary<br/>2500 University Drive NW<br/>Calgary, Alberta, Canada. T2N 1N4<br/><b>Email: rmartinu@ucalgary.ca</b><br/>(403) 220-4151</p> |
| <p><b>Dr. Shantanu Basu</b><br/>Associate Professor<br/>Department of Physics and Astronomy<br/>The University of Western Ontario<br/>London, Ontario, Canada. N6A 3K7<br/><b>Email: basu@astro.uwo.ca</b><br/>(519) 661-2111 ext. 86706</p>                | <p><b>Dr. Roi Gurka</b><br/>Assistant Professor<br/>Department of Mechanical and Materials Engineering,<br/>The University of Western Ontario<br/>London, Ontario, Canada. N6A 5B9<br/><b>Email: rgurka@eng.uwo.ca</b></p>  |