

Dr. Muhammad Umar

Phone: (+92) 3334049966 (Mobile) | **Email:** muhammad.umar@alumni.uni-heidelberg.de | **Website:** <https://typo.iwr.uni-heidelberg.de/groups/compastro/group-members/dr-muhammad-umar> | **WeChat:** umar-593

● ABOUT MYSELF

A programmer with a PhD in Mathematics, offering a unique fusion of analytical depth and technical execution. My core strength is deconstructing complex problems and creating innovative, efficient solutions, grounded in mathematical rigor. I am proficient in Fortran, Python, C++, MATLAB and thrive in collaborative teams focused on delivering high-quality, impactful work.

● EDUCATION AND TRAINING

14/10/2016 – 12/05/2022 Multan, Pakistan
DOCTOR OF PHILOSOPHY (PH.D.) MATHEMATICS Bahauddin Zakariya University

Website caspam.bzu.edu.pk | **Thesis** Numerical Study of Some Non-Newtonian Fluid Flows

26/01/2013 – 15/06/2015 Multan, Pakistan
MASTER OF PHILOSOPHY (M.PHIL.) MATHEMATICS Bahauddin Zakariya University

Website caspam.bzu.edu.pk | **Thesis** An Efficient Parallel Discontinuous Galerkin Flow Solver For Compressible Flows

15/09/2008 – 14/09/2012 Lahore, Pakistan
BACHELOR OF SCIENCE HONOURS (BS(HONS.)) MATHEMATICS Government College University

Website gcu.edu.pk

● WORK EXPERIENCE

 **FATIMA MEMORIAL HOSPITAL - INSTITUTE OF ALLIED HEALTH SCIENCES – LAHORE, PAKISTAN**
ASSISTANT PROFESSOR – 16/11/2024 – CURRENT

- Deliver engaging and effective lectures of mathematics and statistics to undergraduate and postgraduate students.
- Supervise graduate and undergraduate student research projects.
- Participate in curriculum development and the design of new courses.
- Contribute to departmental, faculty, and university committees.

 **INTERDISCIPLINARY CENTER FOR SCIENTIFIC COMPUTING, HEIDELBERG UNIVERSITY – HEIDELBERG, GERMANY**
POST DOCTORAL FELLOWSHIP – 16/11/2023 – 15/08/2024

-Developing the software named GlitchSolve (using FORTRAN, MATLAB, Python) for numerical analysis of the glitching phenomenon in pulsars. Besides, the following software's are online:
<https://typo.iwr.uni-heidelberg.de/groups/compastro/computer-codes-and-numerical-solvers/tov-solver-updated>
<https://typo.iwr.uni-heidelberg.de/groups/compastro/computer-codes-and-numerical-solvers/tov-solver-updated-1>

 **GULF UNIVERSITY FOR SCIENCE & TECHNOLOGY – KUWAIT, KUWAIT**
POST DOCTORAL FELLOWSHIP – 01/2023 – 12/2023

- Developed software for Reduced Order Modelling based blood flow in a stenosed artery using deep learning algorithms.
- Developed python based software to predict the transitional probability of genotype-phenotype mappings using conditional algorithmic probability.
- Parallel implementation of fluid flow solver for incompressible flow and implementation of multi criteria decision making algorithms.

 **THE CAAD GROUP, INTERDISCIPLINARY CENTER FOR SCIENTIFIC COMPUTING, HEIDELBERG UNIVERSITY – HEIDELBERG, GERMANY**

RESEARCH FELLOWSHIP – 04/2022 – 12/2022

- Developed algorithms and software's (using FORTRAN, MATLAB, Python) to compute the numerical results of different astrophysics phenomenon, optimizing and enhancing the efficiency/capability of already developed software's.
- Worked on a text book named, Numerical Astrophysics.
- Worked on the launch new international journal for astrophysics community

 **LAHORE UNIVERSITY OF MANAGEMENT SCIENCES (LUMS) – LAHORE, PAKISTAN**

RESEARCH FELLOWSHIP – 03/2019 – 09/2020

- Upgradation of the software for multi-phase flow phenomenon (using C++) to compute the numerical results of incompressible fluid flows. (40 hours/week)

 **BAHAUDDIN ZAKARIYA UNIVERSITY – LAHORE, PAKISTAN**

RESEARCH FELLOWSHIP – 02/2014 – 02/2019

- Development of highly efficient parallel programming software for the numerical simulations of incompressible fluid flows.
- Supervision of students for projects in FORTRAN, MATLAB and C++.

HONOURS AND AWARDS

07/11/2017

Young Scholar Award – Bahauddin Zakariya University, Multan, Pakistan

Young Scholar Award (**3rd** Position) at CASPAM International Conference on Mathematics and Applications (CICMA), November 6-7, 2017, at Centre for Advanced Studies in Pure & Applied Mathematics (CASPAM), Bahauddin Zakariya University, Multan, Pakistan.

COURSES TAUGHT

Courses

Calculus I, Calculus II, Calculus III, Linear Algebra.
Business Mathematics, Statistics, Fluid Mechanics.
Introduction to Computer & its Applications, Numerical Analysis.
Computing Tools for Mathematicians, Exploring Quantitative Skills.
Programming Languages for Mathematicians, Tools for Quantitative Reasoning.

SKILLS

Source Code Management

GitHub | Doxygen

Programming Languages

FORTRAN | MATLAB | Python | C++ | Flask

Deep Learning Algorithms

PINNs | Autoencoder | CNN and RNN

Parallel Programming

Cluster Installation | MPI Library | OpenMP Library

Mathematics Writing Softwares

LaTeX | Scientific Workplace

Microsoft Office

Microsoft Powerpoint | Microsoft Excel | Microsoft Word

Web Designing

CSS | HTML

● PROJECTS

07/2023 – 12/2023

Blood Flow Analysis using Reduced Order Modelling and Artificial Neural Network

The use of artificial neural networks (ANNs) in constructing Reduced Order Models (ROMs) for complex systems is investigated in this project, specifically for non-Newtonian blood flows with magnetic field effects in an artery with stenosis. The project describes the application of Proper Orthogonal Decomposition (POD) on snapshots of the vorticity field, enabling the construction of a low-dimensional representation of vorticity data.

Estimating Phenotype Transition Probabilities via Conditional Complexities

Developed a python based software to make predictions of phenotype transition probabilities. The findings of this project will be submitted in a well reputed journal in near future.

Multi-Criteria Decision-Making Algorithms

A MATLAB-based customized code to rank the players of National Basketball Association for the season 2019-2020. The code basically ranks the players using multi-criteria decision-making method. 500+ players with over 25000+ matches have been analyzed and ranked based on 14 criterias. The ranking is much more efficient as compared to the ranking by the website.

Blood Flow Analysis

FORTTRAN-based flow solver which numerically simulates the blood flow phenomenon in stenosis arteries. The flow solver is user friendly, although not having a graphical user interface, takes input parameters, and results the numerical values used to analyze the heat and mass transfer in a fluid flow containing different nanoparticles.

Parallel Scientific Computing for Numerical Simulations of Fluid Flow

FORTTRAN-based parallel flow solver for super computers which numerically simulates the incompressible fluid flow problems. The flow solver is designed using OPENMP and OPENMPI in such a way that it can work on shared memory or distributed memory or hybrid memory machines. The flow solver is extended from Euler equations to Maxwell further upto Navier Stokes equations.

Programming

FORTTRAN, MATLAB, C++, and python based solvers for different phenomenons has been written as a Freelancing service, ranging from nuclear reaction mechanism for delayed protons to finite element based flow solvers.

● BOOKS

Numerical Astrophysics

Dr. Ahmad A. Hujeirat, **Dr. Muhammad Umar**
Composing phase.

Essential Calculus: A complete Introduction

Dr. Muhammad Asif, Dr. Muhammad Shahbaz Aasi, **Dr. Muhammad Umar**,
Composing phase.

2022

Tools for Quantitative Reasoning

Dr. Muhammad Asif, Dr. Muhammad Shahbaz Aasi, **Dr. Muhammad Umar**,
Published by Ilmi Kitab Khana.

2022

Exploring Quantitative Skills

Dr. Muhammad Asif, Muhammad Shahbaz Aasi, **Dr. Muhammad Umar**,
Published by Ilmi Kitab Khana.

2018

Simplified Numerical Analysis

● PUBLICATIONS

2025

Numerical Study of Blood Flow in a Stenosed Artery Using Multi-Criteria Decision-Making Algorithm

Muhammad Umar, Muhammad Zeeshan, Shazia Rafiq, Imran Siddique, Bushra Shakoor

Revision Submitted

2025

Data-Driven Reduced Order Modeling of Blood Flow in a Constricted Channel with Magnetic Field Effect using Deep Learning

Hamayun Farooq, **Muhammad Umar***, Volker John, Naveed Ahmed, Syeda Zahra Kazmi

Submitted

2025

Bounding phenotype transition probabilities via conditional complexity

Kamaludin Dingle, Roland Zimm, Pascal Hagolani, **Muhammad Umar**, Samantha O'Sullivan, Ard A. Louis, Journal of the Royal Society Interface, 22(231), (IF=3.5).

2025

Modeling monopole sources in waveguides: Analytical technique for structural variations and Material Contrast

Muhammad Afzal, Muhammad Safdar, Naveed Ahmed, **Muhammad Umar**, Communications in Nonlinear Science and Numerical Simulation, 145, 108714, (IF=3.4).

2021

An efficient parallel scheme based on the nodal discontinuous Galerkin method for fluid flow simulations

Amjad Ali, **Muhammad Umar***, Hamayun Farooq, Muhammad Ishaq; AIP Advances, 11(6), 065031, (IF=1.548).

2021

Cu and Cu-SWCNT nanoparticles' suspension in pulsatile Casson fluid flow via Darcy-Forchheimer porous channel with compliant walls: A prospective model for blood flow in stenosed arteries

Amjad Ali, Zainab Bukhari, **Muhammad Umar**, Muhammad Ali Ismail, Zaheer Abbas; International Journal of Molecular Sciences, 22(12), 6494, (IF=5.923).

2021

Numerical Investigation of MHD Pulsatile flow of Micropolar Fluid in a Channel with Symmetrically Constricted Walls

Amjad Ali, **Muhammad Umar**, Zaheer Abbas, Gullnaz Shahzadi, Zainab Bukhari, Arshad Saleem; Mathematics, 9(9), 1000, (IF=2.258).

2021

Numerical simulation of thermally developed pulsatile flow of a hybrid nanofluid in a constricted channel"

Zainab Bukhari, Amjad Ali, Gullnaz Shahzadi, Zaheer Abbas, **Muhammad Umar**; Energies, 14(9), 2410, (IF=3.004).

2021

Impact of Lorentz force in thermally developed pulsatile micropolar fluid flow in a constricted channel

Muhammad Umar, Amjad Ali, Zainab Bukhari, Gullnaz Shahzadi, Arshad Saleem; Energies, 14(8), 2173, (IF=3.004).

2020

Pulsating flow of a micropolar-Casson fluid through a constricted channel influenced by a magnetic field and Darcian porous medium: A numerical study

Amjad Ali, Muhammad Umar, Zainab Bukhari, Zaheer Abbas; Results in Physics, 103544, (IF=4.476).

2020

Benchmarking of a distributed-memory, high-order discontinuous finite element flow solver on a shared-memory parallel architecture

Amjad Ali, Hamayun Farooq, Gullnaz Shahzadi, Muhammad Umar, Khalid Saifullah Syed; AIP Advances, 10(3), 2020 (IF=1.548).

● **CONFERENCES & SEMINARS**

05/08/2024 – 09/08/2024 Shangla, Pakistan

New Trends in Mathematical Sciences

4th Summer School organized by University of Shangla, Pakistan

26/07/2023 – 30/07/2023 Shangla, Pakistan

New Trends in Mathematical Sciences

3rd Summer School organized by University of Shangla, Pakistan

30/08/2022 – 01/09/2022 Online

Optimization and Numerical Methods in Industries

Virtual Computational Science Summer School organized by KMUTT, IWR, CU and WU.

09/08/2021 – 13/08/2021 Swat, Pakistan

New Trends in Mathematical Sciences

1st Summer School organized by Shangla Campus, University of Swat, Pakistan

04/08/2021 – 05/08/2021 Multan, Pakistan

Win with Mathematics

A two-day online webinar on Win with Mathematics, organized by Centre for Advanced Studies in Pure & Applied Mathematics (CASPAM), Bahauddin Zakariya University, Multan, Pakistan.

19/12/2019 – 21/12/2019 Lahore, Pakistan

Big Data and Cloud Computing, BIGC 2019

Workshop on Big Data and Cloud Computing, BIGC 2019, at Lahore University of Management Sciences (LUMS), Lahore, Pakistan.

19/08/2019 – 20/08/2019 Lahore, Pakistan

International Conference on Applied Mathematics

Organised by Centre for Advanced Studies in Mathematics (CASM), Lahore University of Management Sciences (LUMS), Lahore, Pakistan.

19/12/2018 – 20/12/2018 Multan, Pakistan

Turbulence Modeling and its Simulations

A two-day workshop organised by Centre for Advanced Studies in Pure & Applied Mathematics (CASPAM), Bahauddin Zakariya University, Multan, Pakistan.

28/08/2017 – 28/08/2017

Teaching Undergraduate Mathematics

A one day workshop organised by Centre for Advanced Studies in Pure & Applied Mathematics (CASPAM), Bahauddin Zakariya University, Multan, Pakistan.

13/11/2017 – 15/11/2017 Lahore, Pakistan

International Conference on Mathematics and its Applications (ICMA)

Organised by Government College University, Lahore, Pakistan.

06/11/2017 – 07/11/2017

CASPAM International Conference on Mathematics and Applications (CICMA)

- Organised by Centre for Advanced Studies in Pure & Applied Mathematics (CASPAM), Bahauddin Zakariya University, Multan, Pakistan.
- Attended as a **speaker**.

25/10/2016 – 25/10/2016 Multan, Pakistan

How to Write an Effective Academic Research Paper

RCAPD & ASAAR organised Research Workshop at Bahauddin Zakariya University, Multan, Pakistan.

13/04/2015 – 24/04/2015 Sao Paulo, Brazil

Workshop on Advanced Techniques for Scientific Programming and Management of Open Source Software Packages

Organised by **ICTP & SAIFR** at Sao Paulo, Brazil.

17/03/2015 – 19/03/2015 Islamabad, Pakistan

6th International Conference on Recent Developments in Fluid Mechanics

- Organised by School of Natural Sciences (SNS), National University of Sciences and Technology (NUST), Islamabad, Pakistan.
- Attended as a **speaker**

● MANAGEMENT AND LEADERSHIP SKILLS

Event Manager

- Worked as Event Manager for CASPAM Regional Student Olympiad of Mathematics (CRSOM) in Bahauddin Zakariya University, Multan on yearly basis from 2014 up to 2022.

● RECOMMENDATIONS

Dr. Ahmad A. Hujeirat Research Supervisor

- Head of The CA-AD group, IWR, Heidelberg, Germany.
- Teaching Faculty at Heidelberg University, Germany.
- Teaching Faculty at Basel University, Switzerland.

Email ahmad.hujeirat@iwr.uni-heidelberg.de

Dr. Naveed Ahmed Research Supervisor

Head of Research Center,
Center for Applied Mathematics and Bioinformatics (CAMB),
Department of Mathematics and Natural Sciences,
GULF University for Science & Technology, Kuwait.

Email ahmed.n@gust.edu.kw