

Chinedu Nwaigwe

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Introduction:

I have strong experience in Numerical Analysis, Scientific Computing, and Computational Fluid Dynamics. I develop numerical models and codes, in C++ and Python, and apply them to solve problems arising from fluid dynamics, finance and other transport processes. The C++ code I developed during my PhD was a useful tool for researchers to tackle a flood-sewer challenge during a study group meeting at Cambridge (April 2-6, 2017); I was part of the team. I am currently using OpenMP to extend my PDE code to run on parallel computers. I am also involved in the Centre of Excellence in Offshore and Marine Engineering at the Rivers State University where I teach Numerical Modelling with C++, Python and Java. I have attended and presented papers at several conferences. I recently founded the Mathematical and Scientific Computing Solutions (MSCS) Limited - an organization focused on training Academics and Industry Professionals on how to develop codes and models. I am currently seeking the opportunity for real challenges that involve strategic problem solving at the interface of scientific computing, numerical/applied mathematics and a domain science.

Education

PhD, Scientific Computing and Mathematics

2012 – 2016

University of Warwick, United Kingdom

- Produced a PhD thesis entitled “Coupling Methods for 2D/1D Shallow Water Flow Models for Flood Simulations.”
- Research involves the mathematical and computational modelling of fluid dynamics, particularly the flow and flooding of open channels.
- Detailed study of Conservative Numerical Methods for PDEs.
- Detailed study of theory and numerics of hyperbolic PDEs.
- Developed C++ PDE code for simulating flows in open channels.
- Developed C++ PDE code for simulating flood flows.
- Developed C++ code for simulating coupled flood-channel flows.
- Developed C++ code for solving many mathematical problems including ordinary differential equations; linear and non-linear systems; 2D and 1D mesh generators; vtk files for 3D visualisation; and random number generators.
- Proposed the Horizontal Coupling Method for flood-channel flow.
- Proposed the Vertical Coupling Method for flood-channel flow.
- Implemented the proposed coupling methods in the PDE framework.
- Implemented existing coupling methods from the literature using the PDE framework.
- Developed Matlab code for solving mathematical problems and plotting simulation results.
- Created and utilised git for Version Control of the entire project.
- Visualised results using Paraview, Python, gnuplot.
- Developed all codes and simulations on Linux HPC Machines on the Warwick’s Cluster of Workstations.

MSc, Applied Mathematics -First Class (CGPA: 4.6/5.0) 2005-2007

Rivers State University of Science and Technology, Port Harcourt, Nigeria

- Thesis Title: Unsteady MHD flow of a radiating fluid over a moving heated porous plate with time-dependent suction.
- Formulated the flow models and solved using the perturbation approach; the results were published in a reputable journal.

BSc, Pure and Applied Mathematics - Second Class Upper (CGPA: 4.2/5.0) 1999-2003

Rivers State University of Science and Technology, Port Harcourt, Nigeria

- Project Title: Mathematical Modelling of Ground Temperature.
- Best graduating student in mathematics.

DNIIT – Honours, Software Engineering (Java Technologies) 2009-2012

NIIT India - D/Line Port Harcourt Centre, Nigeria

- Grade: Outstanding (CGPA: 3.75/4.0).

Postgraduate Certificate in Team Working in a Research Environment July 9-11, 2013

University of Warwick, United Kingdom

Professional Skills

- Fifteen years of research experience.
- Seventeen years of teaching experience.
- Thirteen years experience in managing own Start-up Company.
- Thirteen years of supervision experience.
- Attention to detail and a role model to many students and colleagues.
- Passion for problem-solving and to learn new skills.
- Vast experience in departmental management and curriculum design and development.
- Authored Mathematical textbooks and research journal papers.
- Strong communication skills.
- Excellent presentation skills.

Development Skills

- Strong experience in advanced C++ programming with own fluid dynamics C++ software.
- Strong experience in Linux and Windows including nine years of experience in Linux-based HPC systems.
- Strong experience in Python and Matlab for solving PDEs and data analysis.
- Vast experience in Git with personal codes on both Bitbucket and Github.
- Experience in OpenMP and exposure to MPI.
- Experience in Boost library and Eclipse IDE.
- Experience in Unit testing in Eclipse.
- Experience in code debugging using gnu debugger and Eclipse built-in debugger.
- Experience in bash scripting, Make, Gnuplot and Paraview.
- Exposure to Java, Javascript, SQL, HTML, XML, UML and relational databases.
- Strong background and knowledge of numerical methods including Finite Difference, Finite Volume and Finite Element Methods.
- Vast experience in fluid dynamics modelling and Simulations.

- Experience in Monte-Carlo Simulation of Bonds, Stocks and Option pricing.
- Experience in Finite-Difference simulation of Bonds, Stocks and Option Pricing.
- Experience in teaching and mentoring PhD and Masters students in C, C++, Matlab, Bash, Make.
- Mentored PhD students in good programming practices – achieving about forty percent (40%) increase in the efficiency of their Matlab codes.
- Experience in open source PDE software including DUNE-FEM, Deal.II, FEniCS and OpenFoam.

Work Experience

→ **Rivers State University, Port Harcourt, Nigeria**

Position: Senior Lecturer in Mathematics

October 2020 – Date

Duties:

- I teach the following: Numerical Analysis, Partial Differential Equations, Advanced Mathematical Methods, Fluid Dynamics, Linear Algebra, and Engineering Mathematics (Advanced Calculus, Statistics, Differential Equations, Complex Analysis, Vector Analysis), and Business Mathematics.
- Research in Numerical PDEs and Scientific Computing. Current Applications are in Fluid Dynamics and Heat/Mass Transfer process.
- Supervise PhD, MSc and BSc projects.
- Lead the curriculum and instructions development committee in my Department.
- Carry out other administrative duties, including community services.

→ **Rivers State University, Port Harcourt, Nigeria**

Position: Lecturer I in Mathematics

2013-2020

Duties:

- I taught the following: Numerical Analysis, Partial Differential Equations, Advanced Mathematical Methods, Fluid Dynamics, Linear Algebra, and Engineering Mathematics.
- Conducted research in Applied Numerical PDEs.
- Supervised PhD, MSc and BSc projects.

→ **University of Warwick, United Kingdom**

Position: Sessional Teacher in Mathematics and Scientific Computing

2015 – 2016

Duties:

- Taught C-programming and Matlab in Foundation of Scientific Computing module.
- Facilitated student's learning of Linux, Applied Mathematics and Make.
- Delivered practical demonstrations in Scientific Computing (C++ and Numerical Analysis).
- Guided students in writing C++ codes for the numerical solution of linear systems, and ordinary and partial differential equations.
- Assessed students in assignment.

→ **Rivers State University, Port Harcourt, Nigeria**

Position: Lecturer II in Mathematics

2010-2013

→ **Rivers State University, Port Harcourt, Nigeria**

Position: Assistant Lecturer in Mathematics	2007-2010
→ Rivers State University, Port Harcourt, Nigeria	
Position: Graduate Assistant in Mathematics	2005-2007
→ Enhwe Comprehensive High School, Delta State, Nigeria	
Position: SPDC-Sponsored NYSC Mathematics Teacher	2004-2005

Professional Services

- Centre of Excellence in Offshore and Marine Engineering, Rivers State University.
Role: **Lecturer on Numerical Modelling with C++, Python and Java** **2019 - Date**
Role: Teach and develop curriculum on Numerical Modelling with Python, C++ and Java.
- Mathematical and Scientific Computing Solutions Limited.
Role: **Code, Model and Curriculum Developer, and Lead Instructor** **2018 – Date**
Role: Develop curriculum and lead training sessions in Python, Latex, C++, Linux, Inkscape.
- Isaac Newton Institute, Cambridge, United Kingdom.
Environmental Modelling in Industry Study Group (Industry/Academia study group meeting) **April 2017**
Role: Method programmer and presenter. Extended own C++ code to simulate flood-sewer problems. Developed test cases for the flood and channel codes. Generated the numerical data and graphical results for our group. Presented the model and equations part of our work to the general audience.

Administrative roles in University

Rivers State University of Science and Technology, Nigeria,

- Chairman, Curriculum and Instruction Development Committee in the Department (2021).
- Member, Faculty of Science Enforcement Sub-Committee on Covid-19 Protocols.
- Member, Faculty of Science Ethical Approval Committee (2017/2018).
- Department's registration officer: registered students (within and outside the department) taking mathematics courses. This helped the department to optimally allocate the resources for teaching and examination.
- Member, Department board: actively participated in planning on running the Department of mathematics and computer science, this included organising and supervising the examinations of courses taught by the department; ratifying the decisions of the head of department and sub-committees; and approving students' results.
- Member, Faculty board: responsible for planning and running the faculty of science.
- Member of the following department committees: research, staff welfare, and examination planning and monitoring.
- Students' advisor: Advised and mentored many students. There are records of many students improving their academic performance and self confidence after being taught and mentored by me.

Awards and Honours

- **PhD Scholarship Award**, Petroleum Technology Development Fund (PTDF), Nigeria, August, 2012.
- **PhD Scholarship Award, Chancellor International Scholarship**, University of Warwick, United Kingdom, July, 2012.
- **MSc Scholarship Award with Graduate Assistant Position**, Rivers State University of Science and Technology, Port Harcourt Nigeria, August, 2005.
- **John F. Owhochukwu Prize as Best Graduating student in Mathematics**, (BSc. 2001/2002 session) at the Rivers State University of Science and Technology Port Harcourt Nigeria, April, 2004.
- **Undergraduate Scholarship Award**, Uche Foundation Scholarship for Undergraduate Students, January, 1999.

Publications

- 1) **Chinedu Nwaigwe**, A New Second-Order Solver for Nonlinear Convection-Diffusion-Reaction Equations, 2021 (In Review).
- 2) **Chinedu Nwaigwe**, Analysis and Application of a Convergent Difference Scheme to Nonlinear Transport in a Brinkman Flow, *International Journal of Numerical Methods for Heat and Fluid Flow*, <https://doi.org/10.1108/HFF-10-2019-0758>, 30(10), 4453-4473, 2020.
- 3) **Chinedu Nwaigwe**, Sequential Implicit Numerical Scheme for Pollutant and Heat Transport in a Plane-Poiseuille Flow, *Journal of Applied and Computational Mechanics* 6 (1), 13-25, 2020.
- 4) **Azubuike Weli and Chinedu Nwaigwe**, Numerical Analyses of Channel Flow with Velocity-Dependent Suction and Nonlinear Heat Source, *Journal of Interdisciplinary Mathematics*, 23 (5), 2020.
- 5) **Chinedu Nwaigwe and Sudi Mungkasi**, Comparison of Different Numerical Schemes for 1D Conservation Laws, *Journal of Interdisciplinary Mathematics*, 2020 (<https://www.tandfonline.com/doi/abs/10.1080/09720502.2020.1792665>), 2020.
- 6) **Chinedu Nwaigwe**, Mathematical Modelling and Numerical Analyses of Transport Phenomena with Variable Cross-Diffusion and Nonlinear Radiation, *Computational Thermal Science: an International Journal*, 13(1), 73-96, 2020.
- 7) **Baronio, Fabio; Chabchoub, Amin; Esler, Gavin; Field, Joe; Gaskell, Jennifer; Hewitt, Ian; Lombardo, Sara; Marquis, Scott; Nwaigwe, Chinedu; Tzella, Alexandra; Vetra-Carvalho, Sanita; Franklin, James**. Hydraulic Modelling of Collection Networks Study Group 2: Maths Foresees project report, 2018.
- 8) **Chinedu Nwaigwe and Andreas S. Dedner** Formulation, Implementation and Validation of the Horizontal Coupling Method for 1D/2D Shallow Water Flow Models, *under review - preprint* available at arXiv:1701.02577, 2017.
- 9) **Chinedu Nwaigwe and Andreas S. Dedner**, The Vertical Coupling Method: A two layer approach for coupling 1D/2D Shallow Water Flow Models, *under review – preprint available at* arXiv:1701.02577, 2017.

- 10) Chinedu Nwaigwe and Oluwole Daniel Makinde**, Finite Difference Investigation of a Polluted Non-Isothermal Variable-Viscosity Porous Media Flow, *Engineering Fluid Flows and Heat Transfer Analysis – a special issue of the Diffect and Diffusion Forum*, 26, 145-156, (2020).
- 11) C Nwaigwe, A Weli and OD Makinde**, [Computational Analysis of Porous Channel Flow with Cross-Diffusion](#), *American Journal of Computational and Applied Mathematics* 9 (5), 119-132, 2019.
- 12) Nwaigwe, Chinedu and Weli, Azubuiké**, Analysis of Two Finite Difference Schemes for a Channel Flow, *Asian Research Journal of Mathematics* 15 (4), 1-14, 2019.
- 13) E. Amos, J. Ukeme and C. Nwaigwe**, *Magnetohydrodynamic Convective Flow of a Walters' B Fluid through a Non-Homogeneous Porous Medium with Soret Effect. International Journal of Applied Science and Mathematical Theory*, 2019.
- 14) Chinedu Nwaigwe and Charles Orji**, Second-Order Non-Oscillatory Scheme for Simulating a Pressure-Driven Flow, *Journal of the Nigerian Association of Mathematical Physics* 52 (1), 53-58, 2019.
- 15) C. Nwaigwe**, Nedu's Method: A Direct Formula for Evaluating the Integrals of Product of Functions', *Nonlinear Science Letters A*, Vol. 2, No.4: 203-208, 2011.
- 16) C. Nwaigwe and C. Israel – Cookey**, Unsteady MHD flow of a radiating fluid over a moving heated porous plate with time-dependent suction, *Am. J. Sci. Ind. Res.*, 1(1): 88-95, 2010.
- 17) C. Nwaigwe**, Mathematical modelling of ground temperature with suction velocity and radiation, *Am. J. Sci. Ind. Res.*, 1(2): 238-241, 2010.
- 18) C. Nwaigwe, C. Israel – Cookey and E. Amos**, MHD oscillatory Couette flow of a radiating viscous fluid in a porous medium with periodic wall Temperature, *Am. J. Sci. Ind. Res.*, 1(2): 326-331, 2010.
- 19) Chinedu Nwaigwe**, Coupling Methods for 2D/1D Shallow Water Flow Models for Flood Simulations, PhD Thesis at the University of Warwick, United Kingdom, 2016.
- 20) A. Weli, C. P. Amadi and C. Nwaigwe**, Numerical Investigation of Transport in a Couette Flow with Unsteady Suction, *IOSR Journal of Applied Mathematics*, 15(6), 74-83, 2019.
- 21) C. Nwaigwe, R. I. Ndu and A. Weli**, Wall Motion Effects on Channel Flow with Temperature-Dependent Transport Properties, *Journal of Applied Mathematics*, 9(3) ,162-168, 2019.
- 22) Chinedu Nwaigwe and Jonathan**, Thermal Radiation and Chemical Reaction Effects on a Porous Media Flow with Heat Generation, *International Journal of Physics and Mathematics*, 2020.

23) **E. Amos, C. P. Amadi and C. Nwaigwe**, *Free Convection Boundary Layer Flow of a Rotating MHD Fluid past a Vertical Porous Medium with Thermal Radiation. International Journal of Applied Science and Mathematical Theory*, 2019.

Books and Lecture Notes Authored

1) **Chinedu Nwaigwe**, Numerical Modelling with Python (Lecture notes for MSC in Marine and Offshore Engineering) 2019.

2) **Chinedu Nwaigwe**, Introduction to Mathematical Modelling and Advanced Mathematical Methods, 371 pages, ISBN: 978-8068-62-7. Published by Celwil Publisher, Port Harcourt Nigeria, 2012.

3) **Chinedu Nwaigwe**, Teach Yourself Calculus and Its Applications, 631 pages, ISBN: 978-978-50822-7-2. Published by Bluekey Technologies Nigeria Limited, 2012.

Recent Conference Presentations

1) Derivation, Analysis and Application of a Second-Order Scheme for Nonlinear Convection-Diffusion-Reaction Equations in Two-Dimensions. Paper presented at the 39th Annual Conference of the Nigerian Mathematical Society during April 20-24, 2021 at the Redeemer's University, Ede, Nigeria.

2) Stable Numerical Scheme for Pollutant Dispersion in the Flow of a Variable-Viscosity Fluid. Paper presented at the 38th Annual Conference of the Nigerian Mathematical Society during June 18-21, 2019 at the University of Nigeria, Nsukka.

3) The fvsolver: A C++ Code for Research, Teaching and Applications. Paper presented at the 2018 Nigerian Mathematics in Industry Study Group, at Covenant University, Ogun State, Nigeria, during September 24 – 26, 2018.

4) Numerical Simulation of Free-Surface Flows over Complicated Bottom Topography. Paper presented at Departmental of Mathematics Seminar Series, Rivers State University, February 14, 2018.

5) Approaches for coupling 2D/1D shallow water equations. Poster presentation at the International Conference on Hyperbolic Problems, RWTH Germany, August, 2016.

6) Horizontal Coupling Method For 2D/1D Shallow Water Flow Models. Poster presented at the Next Generation Computational Modelling Summer Academy, University of Southampton, United Kingdom, June, 2016.

7) A Coupling Method for 2D/1D Free-Surface Models for Simulating Flooding events. Paper presented at the Sixth Conference on Numerical Analysis and Applications, Lozenetz, Bulgaria. June 2016.

Professional Membership

- Member, Society of Industrial and Applied Mathematics (SIAM).
- Member, Nigerian Mathematical Society (NMS).
- Member, Mathematical Association of Nigerian (MAN).

Mentorship and Other Community Services

- Member, Transformer Maintenance Committee, Iboloji Estate Phase II, East-West Road, Port Harcourt, Nigeria (2021).
- Founder and Leader, Mentorship Group for Nigerian Students (2021).
- Founder, Etche Mathematics Outreach (2020).
- Local Government Returning Officer, Nigerian General Elections (2011).

Language Skills

- English and Etche.

Workshops and Summer Schools Attended

1) Summer School on Financial Mathematics and Boundary Element Methods, University of Jyväskylä, Finland, August 7-18, 2017.

- Implemented Matlab code for Black-Scholes PDES for option pricing using Crank-Nicolson; Implicit and Explicit Euler schemes.
- Developed Matlab code to implement the Euler-Maruyana Scheme for bonds modelling.
- Developed Matlab code to implement the Euler-Maruyana Scheme for Stocks modelling.
- Implemented Monte-Carlo Simulation for stock SDEs.
- Developed Matlab code for modelling portfolio of bond and a single stock, implemented with both Monte-Carlo and Euler-Maruyana methods. Also implemented code for modelling a portfolio of bond and multiple correlated/uncorrelated stocks using Monte-Carlo and Euler-Maruyana methods.
- Wrote Matlab program to study efficient frontier of portfolio.
- Wrote Matlab code for simulating options pricing using Monte-Carlo methods.

2) Message Passing-Programming with MPI, Archer Training at University College London, February 15-17, 2017.

- Parallel programming using the Message-Passage Interface (MPI) model.
- Implemented MPI programs using point-to-point and collective communications.

3) Next Generation Computational Modelling Summer Academy, University of Southampton, United Kingdom, June 20-24, 2016.

- Intermediate Python: Plotted graphs from data files using various python tools including lists, arrays and plotting routines.
- Visualization with VTK/Mayavi: Plotted scientific simulation results using VTK.
- Solving Partial Differential Equations using FEniCS Package: Solved Poisson and Navier Stokes equations using FEniCS.

**4) Software Carpentry workshop,
Imperial College London, March 23-24, 2016.**

- Python: Carried out simple data analysis using python.
- Make: Automated tasks (code compilation) using Make.
- Version Control with git: Implemented cloud computing using git.

**5) CIMPA School on Partial Differential Equations: Analysis, Numerics and Applications to Floods and Tsunamis,
University of Philippines, Diliman Philippines, June 23 – July 4, 2014.**

Attended lectures on the following topics:

- Sobolev Spaces.
- Variational PDEs.
- The water waves equations.
- Numerical methods for some partial differential equations.
- Numerical analysis of flow problems.
- Introduction to the Modelling of Viscous Fluids: Attended lectures on derivations of the Navier Stokes equations and their mathematical analysis.
- Numerical modelling of waves and applications to wind waves, hurricanes and flooding waves.

**6) CIMPA School on Numerical methods in fluid mechanics, mathematical epidemiology and reaction-diffusion systems,
Université Gaston Berger, Saint-Louis, Senegal. September 2-13, 2013.**

Attended lectures on the following:

- Finite volume methods in environmental fluid mechanics.
- Modelisation and numerical simulation of sediment transport problems.
- Numerical methods for reaction-diffusion systems.
- Discontinuous Galerkin methods in environmental fluid mechanics.
- Metapopulation models.
- Dynamical systems in epidemiology.

**7) Summer School on Mathematical Theories towards Environmental Models,
ICTP, Trieste, Italy, May 27 – June 1, 2013.**

Attended lectures on the following:

- Numerical Analysis of Environmental Flows: Covered lectures on Finite Volume and Finite Element Methods for the solution of the partial differential equations arising from environmental fluid dynamics.
- Dynamical Systems and Bifurcation Theory with Applications to the Dynamics of Planet Earth.

**8) Autumn Academy on High Performance Computing,
University of Cambridge. UK. September 10-21, 2012.**

- Numerical Analysis: Revised topics in computational linear algebra and wrote computer programs to implement Matrix algebra.
- Linux: Used Linux terminal to work on files, including navigating through directories; copy, delete, list and rename files, and load text editors.
- C programming: Wrote C-programs for writing from and to terminal and files; and calculate the solution of simple equations.
- OpenMP and MPI : Was introduced to parallel programming.

9) International Workshop and Training in Mathematical Modelling, Neural Network, Data Mining and Scientific Computing Using Matlab and Maple, Covenant University, Ogun State, Nigeria, May 23-27, 2011.

Participated in the following activities:

- Mathematical Modelling of fluid and heat flows.
- Matlab programming - including the basics of Matlab, arrays/vectors, matrices, plots, scripting and functions.
- Wrote Matlab programs to solve ordinary and partial differential equations implementing the Euler's scheme (for time derivative) and finite difference method for spatial derivatives.
- Solved Partial Differential Equations using Maple inbuilt routines.

10) Workshop on Mathematical Modelling and Simulation, National Mathematical Centre Abuja, Nigeria, December 11-14, 2011.

Participated in the following activities:

- Attended Lectures on Matlab and Scilab.
- Used Matlab and Scilab to solve equations and make plots.
- Formulated Navier Stokes Equation and obtain exact solution of simplified form of the equations.
- Formulated some population models including the SIR model.

11) Capacity Building Workshop for Mathematical Sciences' Lecturers in Tertiary Institutions, National Mathematical Centre, Abuja, Nigeria, June 21– 25, 2010.

Participated in the following activities:

- Presented my research entitled "Unsteady MHD flow of a radiating fluid over a moving heated porous plate with time-dependent suction".
- Attended Lectures on several topics including Statistical Package for the Social Sciences (SPSS)

Grants

- Collaborations with Developing Countries grant (2020). This is received in collaboration with Dr Andreas Dedner of Warwick's Mathematics Institute, University of Warwick, UK.
Awarding Agency: London Mathematical Society. grants@lms.ac.uk; +44(0)20 7291 9973.
Award Reference Number: 51910.
Goal: To develop methods that efficiently couple large river networks typically simulated by 1D river models with high-dimensional flood models.

Referees

- Dr Andreas Dedner,
Associate Professor of Mathematics,
University of Warwick, United Kingdom.
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- Dr Tristan Pryer,
Reader, Department of Mathematical Sciences,
University of Bath, United Kingdom.
tmp38@bath.ac.uk; [+44 \(0\) 1225 383789](tel:+441225383789).
- Professor Adols O. Nwaoburu,
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Rivers State University, Nigeria.
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