Ali Taqi; Ph.D., BEng(Hons)

Scientific Computing Expert; Assistant Professor; Chemical Engineer

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A Muscat. OM

Oxford, UK 10/2022 - 12/2024

Profile

Expert in Scientific Computing with advanced scientific & technical knowledge. Delivering next-generation STEM solutions through first-principles' algorithms, numerical modelling & ML integration. Proven expertise in scaling software/algorithms for research/commercial use & LLM-driven enhancements via parallel computing & GPU programming. Rich & diverse experiences to date spanning radio astronomy, advanced engineering, renewable energy & electromagnetic applications; demonstrating outward-thinking, eagerness to learn/solve, swift adaptability, risk-taking & an entrepreneurial mindset. Passionate about leveraging attained experience towards leading revolutionary scientific discoveries & cutting-edge engineering solutions in the future.

Programming Expertise

Core programming & parallelisation: C; C++; Python; Bash; Solidity; Java; CUDA; DASK Containerisation, cluster management & ML frameworks: Kubernetes; Docker; Singularity; Slurm; pytorch Systems, front-end & DevOps: Linux; Git; SQL; HTML; CSS; Javascript; Sphinx Commercial software: HYSYS & UNISIM (process simulation); COMSOL (fluid flow); AutoCAD (GA, PFD, P&ID)

Relevant Experience

Assistant Professor, (Sultan Qaboos Univ.) Muscat, OM 01/2025 - present • Developing algorithms suited for **parallel computing** to enhance green hydrogen production. This incorporates simulating various multi-scale, first-principles' phenomena to optimise costs, stabilise production, & improve process efficiency.

Visiting Researcher, (Univ. of Oxford)

Oxford, UK 01/2025 - present • Investigating advanced radio-imaging methods away from the fundamental yet limiting assumption that sky brightness & observed radio signals are 2D Fourier-related. This entails thorough first-principles' RIME & interferometry investigations, promising revolutionised image/signal processing for radio astronomy in the future.

Scientific Computing Researcher for the SKA telescopes, (Univ. of Oxford)

- Contributed to several aperture synthesis-based SKA pipelines, via: (1) improving scientific concepts, e.g., Voronoi tessellations to generate reliable sky facets; (see specimen); (2) parallelising code to support HPC runs while maintaining scientific rigour, e.g., for RFI-flagging (see specimen); (3) introducing user-configurability to greatly widen the domain of science use-cases by supporting user-determined steps/interfaces, e.g., for self-calibration strategies (see specimen).
- Innovated algorithms to approximate antenna beams as Zernike polynomials (see repo), delivering 4-fold reduction in memory demand for processing said beams, thereby promising major advances in wide-field imaging for radio telescopes (see presentation).
- Innovated ML-based algorithms using numerical & Monte-Carlo approaches to optimise sky-source clustering driven by cluster area, source proximity & balancing flux distribution, thereby greatly enhancing DDE calibration & improving image quality **by 50%** (TBC; publication WIP; repo will be made available).
- Led a group effort to enhance sky-image deconvolution from first principles via MEM. Despite its unique scientific rigour, this method is not well-pursued as it currently suffers from complex algorithmic & computational demands.
- Investigated parallelised re-ordering of giga-bytes of astronomical input MeasurementSet data via CUDA (GPU programming), accelerating this vital input-output bottleneck 2-fold for sufficiently large datasets (repo will be made available).
- Led cross-functional coordination across a diverse team of astronomers, data scientists & engineers to deliver key innovations (e.g., aforementioned points), in line with the project's scientific goals & strategic objectives of relevant gov't funding agencies.
- Researcher in Biomass & Microwave Processing, (Univ. of Nottingham) Nottingham, UK 07/2017 - 09/2022
- Fundamentally integrated the 3D-spatial-plus-time heat & mass/osmosis equations using rarely investigated temp.-variable extensions of statistical mechanics. This algorithm enabled modelling diffusion under non-uniform temp. for the first time.
- Engineered a first-principles' software for biomass extraction under microwave heating, based on the framework above but also incorporating **biological tissue expansion** (solid mechanics) & **electromagnetism** (Maxwell equations' derivatives).
- Delivered unprecedented insights with the software, showing that a microwave-induced temp. diff. of just 1°C enhances tissue rupture. This drew multidisciplinary interest into microwave processing, e.g., novel desalination methods (see publication).
- Led a cross-functional research/industrial team at designing/constructing pilot-scale units for microwave extraction & torrefaction of biomasses driven by the software, reducing processing times from minutes to seconds & promising significant breakthroughs for a more robust & economically competitive bio-refinery concept.

- Steered a cross-functional proposal (with Pharmacy & nmRC) for an *in-vivo* investigation of microwave-induced water diffusion within biomasses, driven by the software. This ranked top-10 amongst many funding applications.
- Currently up-scaling the software for **optimised industrial use** via **code parallelisation** & **incorporating ML algorithms**, e.g., with pytorch (several publications WIP; repo will be made available).

Relevant Publications & Outreach

- Understanding Microwave Heating in Biomass-Solvent Systems, Chem. Eng. J. 393, p.124741
- Water Desalination using a Temperature Gradient, Desalination 464, pp.1-7
- Lowering In-Memory Footprint of Antenna Beams via Polynomial Approximation, ADASS 2024, Valletta, Malta
- Enhanced Extraction in Biomass-Solvent Systems Under Microwave Heating may not be Caused by Cell Rupture, *Total Food 2022, Nott'm, UK,* Awarded: Student Bursary sponsored by Inglehurst Foods
- Temperature Induced Diffusion A new microwave effect?, AMPERE 2021, Virtual
- Conference talk: Understanding Microwave Heating in Biomass-Solvent Systems, IOP Food Physics 2021, Virtual
- Applicability of the Chemical Potential Hypothesis to Biomass-Solvent Systems Subjected to Microwave Heating: Heat Transfer Analysis, IMPI Int'l Microwave Power Symposium 2019, Las Vegas, NV, Awarded: Best Poster Prize & Student Bursary

Education

 Ph.D. Chemical Engineering Univ. of Nottingham
 Nottingham, UK 2017-2022

 Thesis title: Understanding the Influence of Microwave Heating on Biomass-Solvent Extraction.
 BEng(Hons) Chemical Engineering - 86% First Class Univ. of Nottingham

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 Nottingham, UK 2013-2016

 First on cohort — Plant design; hydrogen production; water treatment; nano-particle production; pharmaceuticals; nuclear pre-treatment — Reactor design; separation processes; process control; HYSYS; AutoCAD; P&ID.

Courses & Certifications

- EDAD consultancy training for Arabic-speaking talents in Europe (Apr. 2024) McKinsey & Co., UK
- SAFe Practitioner as a Developer & Product Owner (Aug. 2023) SAFe, UK
- CUDA Programming on NVIDIA GPU's (Jul. 2023) Univ. of Oxford, UK
- Synthesis Imaging for Radio Astronomy (Jun. 2023) NRAO, Virginia
- National Youth Programme for Skills' Development (Sep. 2019) Diwan of Royal Court, Oman
- Introduction to Programming (Oct. 2018) Udacity, California

Awards

- Tri-Campus Andrew Hendry Award for Ph.D. research excellence (2021) Univ. of Nottingham, UK
- Frank Whitt Prize for scoring the highest grade on graduation (2016) Univ. of Nottingham, UK
- University Award for scoring the highest grade on graduation (2016) Univ. of Nottingham, UK
- BP Award (twice) for academic excellence (2014/15) BP Chemicals Ltd., UK
- Dean of Engineering Award (twice) for academic excellence (2014/15) Univ. of Nottingham, UK
- University Award for scoring the highest grade on graduation (2013) Loughborough Univ., UK

Further Experience

 Lecturer: Chemical & Environmental Engineering, (Univ. of Nottingham)
 Nottingham, UK
 07/2017 - 10/2022

 • Contributed to developing courses with modern digital tools (e.g., DCS simulation for LNG plant start-up).
 Full-Stack Web Developer, (National Youth Programme for Skills' Development)
 Muscat, OM
 08/2017 - 09/2018

• Developed a website for a start-up prototype using HTML, CSS, Javascript, Django & API.

Process Engineer & Refinery Operator, (OQ)

• Leveraged HYSYS & UNISIM for dynamic process simulation, playing a key role at refinery operations & troubleshooting.

Muscat/Jifnain, OM 02/2017 - 06/2017

- Managed day-to-day operations across multiple refinery units inc. **diesel hydro-desulfurisation**, **naphtha reforming**, **crude distillation** & **LPG production**, ensuring efficient processing & compliance with industry standards.
- Actively contributed to a refinery expansion plan through participating in relevant HAZOP safety studies.
- Contributed to the **design** & **commissioning** of the MSPP a strategic pipeline & storage facility for refinery products.

Note: blue text represents clickable hyperlinks providing additional background information; hence, view this document on a computer.