

AFSHIN GHORBANI

B.Sc. Candidate in Chemical Engineering

Shiraz University

Shiraz, Iran

Prospective graduate researcher for Fall 2027 or Winter 2028, open to M.Sc. and Ph.D. positions

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RESEARCH INTERESTS

- Separation process design
- Multiphysics transport modelling
- Phase-equilibrium modelling
- Numerical methods and computing
- Bioprocess engineering
- Metabolic and systems modelling

EDUCATION

Shiraz University

Fall 2023 – Present

B.Sc. in Chemical Engineering (expected Spring 2027)

Shiraz, Iran

- GPA 17.93 / 20.00; 18.52 / 20.00 over the last two years (Iranian 0–20 scale, on which 17 and above is equivalent to an A and 18 and above to an A+). Ranked **3rd of 41**, and among the top three of the cohort in every semester.
- **Perfect 20.00 / 20.00 in six core courses:** Mass Transfer, Unit Operations I, Numerical Methods, Introduction to Biological Sciences, and the Heat Transfer and Fluid Mechanics laboratories.
- Thermodynamics I (19.50) and II (19.30), Engineering Mathematics (19.40), Organic Chemistry (19.30), Computer Programming (19.00), Fluid Mechanics II (18.90), Heat Transfer I (18.90). Every semester since Fall 2024 above 18 / 20.

RESEARCH EXPERIENCE

International Sturgeon Research Institute

Jul 2026 – Sep 2026

Research Intern, Biochemistry Laboratory (supervised)

Rasht, Iran

- Carried out quantitative **oxidative-stress biomarker assays** on tissue samples (**catalase activity** and **malondialdehyde**, MDA) under standardised protocols.
- Owned the full bench workflow: tissue homogenisation, preparation of buffers, reagents, and calibration standards, centrifugation, and **spectrophotometric quantification** against self-generated standard curves, through to data interpretation.

Computational Framework for McCabe–Thiele Distillation Design

Spring 2026 – Present

Self-directed research project, initiated alongside Unit Operations I

MATLAB, TypeScript

- Designed and implemented from first principles a modular solver for binary distillation: spline fitting of experimental **vapour–liquid equilibrium** data, operating and q -lines, curve-intersection detection, a **minimum-reflux pinch search** that resolves tangent pinches in non-ideal systems, automated stage stepping, and **Murphree efficiency** via a pseudo-equilibrium curve against which stages and minimum reflux are recomputed.
- Generalised the model (version 2, MATLAB) beyond the textbook case to **multi-section columns with multiple arbitrary feeds, side streams, and subcooled reflux**.
- Re-engineered version 1 as a **public interactive design tool** with a standalone numerical engine, verified by a 21-case regression suite that reproduces the reference results to within 10^{-9} (see Research Software).

Multiphysics Modelling of Evaporative Cooling

Fall 2025

Individual course project, Mass Transfer

COMSOL Multiphysics

- Built a **three-dimensional COMSOL model** coupling turbulent airflow, heat transfer, and evaporative mass transfer for the cooling of a liquid-filled ceramic vessel, solving a stationary turbulent-flow field followed by transient heat and moisture transport.
- Ran a parametric sensitivity study over ambient temperature, relative humidity, and latent heat of vaporisation, and **quantified the role of evaporation:** neglecting latent heat shifts the predicted 10-minute liquid temperature by roughly **14%**, whereas humidity is a second-order effect.
- Sole author of the model and the technical report, on a project scoped for a team of two; course grade **20 / 20**.

Nonlinear Material-Balance Modelling of a Crystallisation Process

Fall 2024

Course project, Numerical Methods

MATLAB · 20 / 20

- Formulated a **six-variable nonlinear material-balance model** of purification by crystallisation and implemented a Newton-based solver; diagnosed why the Newton formulation failed to converge, recovered the solution set symbolically, and verified it independently by re-deriving the balances around alternative process boundaries with component-level conservation checks.

RESEARCH SOFTWARE

McCabe–Thiele Distillation Designer (TypeScript, React; open source, live). Interactive column design in the browser: stage count, feed stage, minimum reflux, Murphree efficiency, user-supplied equilibrium data, and a mass-balanced column schematic; every control documents its governing equations.

iamafshin.me/apps/mccabe-thiele ·  [source](#)

cheme-thermo-solvers (MATLAB; open source, public release in preparation). Iterative solvers for multicomponent **vapour–liquid equilibrium**, bubble- and dew-point calculations, and non-ideal liquid-phase activity coefficients by the **UNIFAC** group-contribution method.

numerical-methods-cheme (MATLAB; open source, public release in preparation). LCIInterpol, a multi-variable **nonlinear regression engine**, applied to parameter estimation for Arrhenius rate expressions and growth-kinetics models.

TECHNICAL SKILLS

Modelling & Simulation	COMSOL Multiphysics (turbulent flow, coupled transient heat and mass transfer, parametric studies); stage-wise separation design; phase equilibria and UNIFAC; nonlinear material balances
Scientific Computing	MATLAB (nonlinear systems, Newton and iterative schemes, symbolic computation, regression, spline interpolation); TypeScript/JavaScript (React, automated regression testing); $\LaTeX$; Git
Laboratory	Catalase and MDA assays, spectrophotometry, standard-curve quantification, tissue homogenisation, centrifugation, buffer and standard preparation, micropipetting
Currently Developing	Constraint-based metabolic modelling (COBRA Toolbox) for a systems-biology project; Python; Simulink

HONOURS & AWARDS

“Exceptional Talent” status, Shiraz University (105 of 142 credits before the final year)	2026
Top 1% of 136,000, Iranian University Entrance Exam (<i>Konkur</i>), Maths and Physics group	2023
Full government tuition waiver for the B.Sc. degree, Shiraz University	2023 – 2027
Advanced past the first stage, Iranian National Chemistry Olympiad	2021

TEACHING & MENTORING

Teaching Assistant, Thermodynamics I , Department of Chemical Engineering, Shiraz University. Led weekly problem-solving sessions (2–4 hours per week) for a class of more than 40 undergraduates .	Fall 2025
Volunteer Peer Instructor , Student Learning Centre for Accessible Learning, Shiraz. Taught material balances, thermodynamics, and fluid mechanics to groups of petroleum engineering students in pre-examination sessions.	2024

TECHNICAL REPORTS & PRESENTATIONS

Multiphysics Modelling of Evaporative Cooling . Technical report, Mass Transfer.	Fall 2025
Biological Sorption: Biosorption and Bioaccumulation . Literature review and oral presentation linking biological uptake to adsorption equilibria and isotherms; graded 20 / 20.	Spring 2025

LEADERSHIP, LANGUAGES & CERTIFICATIONS

- **Coordinator and session leader**, Free Discussions in Foreign Languages, Shiraz University, Summer 2024: organised and led 12 open sessions in English and German.
- **Languages:** Persian (native) · English (fluent) · German (intermediate, A2–B1). **Certification:** HSE (Health, Safety and Environment), June 2024.