

Academic Curriculum Vitae



Personal Information:

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Education:

- 2012 Doctor of Philosophy (Ph.D.) in Mathematics, Cardiff University, UK
Thesis title: Approximation of Quadratic Numerical Range of Block Operator Matrices.
- 2004 Master of Science (M.Sc.) in Mathematics, College of Science, Salahaddin University- Erbil, Iraq
Thesis title: Some generalizations of Numerical Range of operators on a complex Hilbert.

Research interests

My research lies in the fields of functional analysis, operator theory and spectral theory. I am particularly interested in numerical range of operator matrices, numerical range of operator polynomials, c -numerical range of operator matrices, q -numerical range of operator matrices, q -numerical range of operator polynomials, S -numerical range of operator matrices, S -numerical range of operator polynomials and quadratic numerical range of block operator matrices (theory and numerics).

One of the main achievements of my research to date has been the absence of quadratic numerical range-pollution, which is new result in operator theory because in general, discretization of differential operators may result in spectral pollution. I have shown that the proof of this does not happen for finite difference discretizations of the Hain-L^u operator is a little more tricky than proving that every point of the quadratic numerical range can be approximated. I require the following concept, which has not been introduced before, and which I expect will be useful in many contexts when dealing with unbounded block operator matrices.

Employment:

- **Since 03/2022** Assistant Professor ,Salahaddin University -College of Science-Department of Mathematics
- **15/9/2012** PhD, Department of Mathematics, College of Science, University of Salahaddin.
- **10/2018-09/2012** Ph.D. student & teaching assistant, Cardiff School of Mathematics- Cardiff University, UK.
- **10/2005-07/2008** Lecturer, Department of Mathematics, College of Science, University of Salahaddin.

- 09/2002-09/2005 Assistant Lecturer, Department of Mathematics, College of Science, University of Salahaddin.
- 09/2000-09/2002 Master student, Department of Mathematics, College of Science, University of Salahaddin.

Specific specialization: Numerical range of differential operators

General specialization: Operator Theory and Functional analysis

Qualifications

- Referee of some international Mathematical journal .
- member of Discussion Committee of Master theses and PhD Dissertations:
- Supervising undergraduate and postgraduate Students.
- Participating in different workshops and conferences.
- Being a member in various committees on the level of the department and the college.
- 11/2002-06/2008: Deputy Head of Department of Mathematics, College of Science, Salahaddin University-Erbil, Iraq.
- 09/2004 -06/2008 Member of the Scientific and Higher study committee of the Department of mathematics.
- 2003-2006 Member of final examination committee of B.Sc of the College of Sciences.
- 2007 Member of final examination committee of M.Sc and PhD. of the College of Sciences
- 2008 Member of final examination committee of B.Sc of the College of Sciences.
- 2014 Member of final examination committee of B.Sc of the College of Sciences.
- 01-09-2023-present: Member of the Scientific and Higher study committee of the department of mathematics.
- 2023-2024: Member of final examination committee of M.Sc and PhD. of the college.
- 01-09-2023-present Section editor of Zanko journal of pure and applied science.
- member in most comities in the Salahaddin University especially in the College of , Sciences.

Teaching experience:

I have taught a variety of undergraduate courses in calculus, multivariable calculus, vector calculus, foundation of mathematics, fundamental of mathematics, linear algebra, differential equations, topology on real line, linear programming, non-linear programming, abstract algebra, mathematical analysis, functional analysis and complex analysis.

- 2002 - 2003 : Assistant Lecturer, Department of Mathematics- College of Science, University of Salahaddin,, Erbil-Iraq.
Teaching Courses: Functional analysis, (first and second semesters), Abstract Algebra, (first and second semesters), Ordinary differential equation, (first semester), Linear Programming (second semester).
- 2003--2004 : Assistant Lecturer, Department of Mathematics- College of Science, University of Salahaddin,, Erbil-Iraq.
Teaching Courses: Functional analysis, (first and second semesters), Linear Algebra, Abstract Algebra (second semester).
- 2004 - 2005: Assistant Lecturer, Department of Mathematics- College of Science, University of

Salahaddin,, Erbil-Iraq.

Teaching Courses: Foundation of Mathematics, (first and second semesters), Mathematical Analysis, (first and second semesters).

- 2005-2006: Lecturer, Department of Mathematics- College of Science, University of Salahaddin,,Erbil-Iraq.
Teaching Courses: Foundation of Mathematics, (first and second semesters), Mathematical Analysis, (first and second semesters), Complex Analysis, (first and second semesters)
- 2006--2007 : Lecturer, Department of Mathematics- College of Science, University of Salahaddin,, Erbil-Iraq.
Teaching Courses: Foundation of Mathematics, Advanced Calculus, Mathematical analysis.
- 2007- 2008: Lecturer, Department of Mathematics- College of Science, University of Salahaddin,,Erbil-Iraq.
Teaching Courses: Foundation of Mathematics, Mathematical analysis, Complex analysis.
- Oct. 2008-- Sept. 2012 : PhD student at Cardiff school of Mathematics-Cardiff University, UK.
- Oct. 2012 - 2013: Lecturer, Department of Mathematics- College of Science, University of Salahaddin,, Erbil-Iraq.
Teaching Courses: Linear algebra, abstract algebra..
- 2013- 2014: Lecturer, Department of Mathematics- College of Salahaddin,, Erbil-Iraq.
Teaching Courses: Fundamental of Mathematics, functional analysis.
- 2014--2015 : Lecturer, Department of Mathematics- College of Salahaddin,, Erbil-Iraq.
Teaching Courses: Fundamental of Mathematics, Advanced Calculus.
- 2015- 2016: Lecturer, Department of Mathematics- College of Science, University of Salahaddin,, Erbil-Iraq.
Teaching Courses : Foundation of Mathematics.
- 2016—2017: Lecturer, Department of Mathematics- College of Science, University of Salahaddin,, Erbil-Iraq.
Teaching Courses: Foundation of Mathematics.
- 2017- 2018: Lecturer, Department of Mathematics- College of Science, University of Salahaddin,,Erbil-Iraq.
Teaching Courses: Advanced Calculus, Functional Analysis.
- 2018- 2019: Lecturer, Department of Mathematics- College of Science, University of Salahaddin,, Erbil-Iraq.
Teaching Courses: Advanced calculus, Functional Analysis.
- 2018- 2019 Visiting Lecturer, Department of Mathematics- College of Science, Koya University.
Teaching Courses: Mathematical Analysis.

- 2019- 2020: Lecturer, Department of Mathematics- College of Science, University of Salahaddin,,Erbil-Iraq.
Teaching Courses: Mathematical Analysis Analysis.
- 2020- 2021: Lecturer, Department of Mathematics- College of Science, University of Salahaddin,,Erbil-Iraq.
Teaching Courses: Multivariable Calculus, Mathematical Analysis.
- 2021- 2022: Lecturer, Department of Mathematics- College of Science, University of Salahaddin,,Erbil-Iraq.
Teaching Courses: Multivariable Calculus, Mathematical Analysis.
- 2022- 2023: Assistance professor, Department of Mathematics- College of Science, University of Salahaddin, Erbil-Iraq.
Teaching Courses: Multivariable Calculus, Functional Analysis.
- 2023- 2024: Assistance professor, Department of Mathematics- College of Science, University of Salahaddin, Erbil-Iraq.
Teaching Courses: Complex analysis, Functional Analysis.
- 2023- 2024: Visiting Lecturer, Department of Mathematics- College of Science, Koya University .
Teaching Courses: Mathematical analysis, Functional Analysis.
- 2023- 2024: Visiting Lecturer, Department of Mathematics- College of Science, Soran University .
Teaching Courses: Operator theory.

On the other hand I have taught a variety of postgraduate courses in spectral theory, operator theory and functional analysis.

- 2014 - 2015: Lecturer, Department of Mathematics- College of Science, University of Salahaddin,, Erbil-Iraq.
Teaching Courses: Functional analysis II (Master students).
- 2015--2016 : Visiting Lecturer, Department of Mathematics- College of Science, Soran University.
Teaching Courses: Functional Analysis (Master students-first semester).
- 2017- 2018 : Visiting Lecturer, Department of Mathematics- College of Science, Koya University.
Teaching Courses: Functional Analysis (Master students-first semester).
- 2020- -2021: Visiting Lecturer, Department of Mathematics- College of Science, Koya University.
Teaching Courses: Functional Analysis II (PhD students)
- 2020—2021: Lecturer, Department of Mathematics- College of Science, University of Salahaddin,,Erbil-Iraq.
Teaching Courses: Operator theory (Master students- second semester).
- 2020--2021 Visiting Lecturer, Department of Mathematics- College of Science, University of Sulaimani

- Teaching Courses: Spectral theory (master students- second semester).
- 2023- 2024: Assistance professor, Department of Mathematics- College of Science, University of Salahaddin, Erbil-Iraq.
Teaching Courses: Functional Analysis(first semester- Master) + Spectral theory (second semester - Master)
 - 2023- 2024: Visiting Lecturer, Department of Mathematics- College of Science, Koya University .
Teaching Courses: , Functional Analysis II (first semester PhD) + Linear analysis (second semester – Master).
 - 2023- 2024: Visiting Lecturer, Department of Mathematics- College of Science, Soran University .
Teaching Courses: Operator theory. (first semester –PhD).

Supervision of Master theses

- 01/07/2024- present : Rawaz Hassan Maoulod, current Master student; Thesis titled Approximation of numerical range of operator linear pencil .
- 01/07/2021- 01/12/2022 : Darawan Zrar Muhammad,
Master thesis titled On the computing S-numerical range of polynomial Operator matrices .
- 01/4/2018-12/3/2020 : Berivan Faris Aziz,
Master Thesis titled On the approximation of Krein space numerical range of operator matrices with applications.
- 15/11/2015-27/4/2017 : Walat Jalal Hamad,
Master Thesis titled Approximation of generalized numerical range of operator matrices with applications.
- 01/09/2014-13/12/2015: Fiza Abdullah Shareef,
Master Thesis titled Approximation of q-numerical range of operator matrices with applications.

Supervision of PhD theses

- 01/05/2024- present : Wlat Jalal Hamad, current PhD student; Thesis titled Computing quadratic numerical range of operator polynomial.
- 01/04/2021- present : Amer Muhammad Salman,
Current PhD student; Thesis titled On Stability analysis.
School of Mathematical Sciences Universiti Sains Malaysia

Books

- Ahmed Muhammad and Hardi Nabe, Advanced Calculus, University of Salahaddin-Erbil, 2022-2023.

- Ahmed Muhammad and Hardi Nabe, Mathematics for Ten year class, Gasha institute 2015-2016.
- Ahmed Muhammad and Hardi Nabe, Mathematics for Eleven year class, Gasha institute 2015-2016.
- Ahmed Muhammad and Hardi Nabe, Mathematics for Televe year class, Gasha institute 2015-2016.

Research and publications

- 1- A. Muhammad and W. Hammad, Computing \mathcal{S} -numerical range of differential operators, Journal of Filomat 38:77(2024), 2243-2225.
- 2- Amer M. Salman, Mohd Hafiz, and Ahmed Muhammad, A Novel Approach to investigate the Stability Analysis and the Dynamics of Reaction-Diffusion SVIR Epidemic Model. Communications in Nonlinear Science and Numerical Simulation 126 (2023) 107517.
- 3- A. Muhammad, B. Azeez, and F. Taheri, Computing the \mathcal{SS} -numerical range of differential operators, Journal of Operator and Matrices 17 (2023), 583-598.
- 4- A. Muhammad, Approximation of numerical range of polynomial operators. Journal of Operator and Matrices 15 (2021), 1073-1087.
- 5- A. Muhammad and F. Shareef, Computing the \mathcal{S}_q -numerical range of differential operators, Journal of Applied Mathematics Volume 2020, Article ID 6584805, 12 pages, (2020).
- 6- A. Muhammad and F. Shareef, A numerical investigation of \mathcal{S}_q -numerical range of operator matrices. Far east Journal of mathematical science 125 (2020), 1-33.
- 7- W. Jalal and A. Muhammad, Elliptic numerical range of matrices. International mathematical Forum 15 (2020), 293-315.
- 8- B. Azeez and A. Muhammad, Some results on \mathcal{S} -numerical range of operator matrices. Zanko Journal of pure and Applied science 32 (2020), 57-63.
- 9- A. Muhammad and W. Jalal, A numerical investigation of the \mathcal{S} -numerical range of differential operator. Bulletin of Iranian mathematical society 45 (2019), 1755-1775.
- 10- A. Muhammad and M. Marletta, A numerical investigation of the quadratic numerical range of Hain-L $\{u\}$ st operator. International Journal of Computer Mathematics 90 (2013), 2431-2451.
- 11- A. Muhammad and M. Marletta, Approximation of quadratic numerical range of block operator matrices. Integral Equation and Operator Theory 74 (2012), 151-162.
- 12- A. Muhammad and M. Marletta, Computation of boundary of quadratic numerical range (Approved to be published).

- 13- A. Muhammad, Joint Numerical Range of matrix polynomials. Al-Rafiden Journal of Computer Science and Mathematics, Vol.6 No.2 (2009), p.129-136.
- 14- A. Muhammad, The Numerical range of 6 by 6 Irreducible matrix, Al-Rafiden Journal of Computer Science and Mathematics, Vol.4 No.2 (2007), p.89-98.
- 15- A. Muhammad, The line segment on the boundary of Numerical range, Zanco, The Scientific journal of Salahaddin University-Erbil, Vol.17 No.1 (2005), p.105-111.
- 16- A. Muhammad, Elliptical Range of an n-tuple operators on a complex Hilbert space, Zanco, The Scientific journal of Salahaddin University-Erbil, Vol.17 No.1 (2005), p. 113-117

School, Workshop and Conferences

- Young Researchers Workshop on Spectral Theory, Quantum Chaos and Random Matrices, June 29th-July 1st, 2009, Cardiff University, UK. .(seminar presenter)
- Workshop on Spectral Theory, Quantum Chaos and Random Matrices, June 29th-July 1st, 2010, Cardiff University, UK. .(seminar presenter)
- CIMPA research school inverse Problems: Theory and Applications, May, 5-14, 2014. Salahaddin University, Erbil-Iraq. .(seminar presenter)
- An Introduction Workshop of Mathematics and Physics with their Applications. October,3-4, 2018, Salahaddin University, Erbil-Iraq.
- Second International Conference of Mathematics (SICME 2019), February 3-5 2019, Salahaddin University, Erbil-Iraq.
- Gathering Kurdish Mathematics Researcher Meeting with Caucher Birkar Workshop, April , 1-2 , 2019, Salahaddin University, Erbil-Iraq. .(seminar presenter)
- First International Conference of Mathematics (FICM 2020), September, 24-25, 2020,, Sulimani University, Sulimani -Iraq.
- International Workshop on Topics in Algebra number theory.: the west Asia Mathematical School (WAMS- Erbil), October 2021.
- Workshop on New Approaches to Improve Teaching Quality of University Level Mathematics, October 14, 2021, Tishk International University, Erbil-Iraq.
- Third International Conference of Mathematics and Applications (TICMA2022), August 29th-31st, 2022, Salahaddin University, Erbil-Iraq.
- Workshop on Topics in algebraic number theory , August 23-28, 2022.,Salahaddin University, Erbil-Iraq.

Courses attended

During my PhD study I have attend MAGIC courses:

- Linear Differential Operators in Mathematical Physics
- Spectral theory of ordinary differential operators
- Banach spaces and Fredholm theory
- Introduction to Linear Analysis

Funding and academic awards

Full financial PhD research supported by the Iraqi Ministry of Higher Education and Scientific Research.