



## Academic Curriculum Vitae

### Personal Information:

Full Name: Dr. Ahmed Muhammad  
Academic Title: Assistant Professor  
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## Education

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- October 2008 – April 2012 (UK): PhD in Mathematics (Operator Theory).

**Institution:** Cardiff School of Mathematic- Cardiff University, UK  
**Thesis title:** Approximation of Quadratic Numerical Range of Block Operator Matrices.

- October 2002 – August 2004 (Iraq): M.Sc. in Mathematics (Functional Analysis).

**Institution:** Department of Mathematic- College of Science, Salahaddin University- Erbil, Iraq  
**Thesis title:** Some generalizations of Numerical Range of operators on a complex Hilbert spaces.

## Research interests

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My research interests are in functional analysis, operator theory and spectral theory. In particular I am interested in:

- Spectral approximation for linear operators ( spectral pollution ).
- Numerical range of differential operators and operator pencils, and involve both analysis and computational mathematics.
- Differential operators, e.g. Schrödinger operators, Advection-diffusion operators, Hain-Lust operators and Stokes operators .
- Applications in mathematical physics, e.g. in magnetohydrodynamics

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 this does not happen for finite difference discretizations of the Hain-Lüst operator is a little more tricky than proving that every point of the quadratic numerical range can be approximated.

## Academic positions

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- March 2022- present: Assistance Professor, Department of Mathematics, College of Science University of Salahaddin.
- October 2012: Lecturer, Department of Mathematics, College of Science University of Salahaddin.
- October 2008 – April 2012 (UK): PhD student and teaching assistant, Cardiff School of Mathematics, Cardiff University.
- October 2005- August 2008: Lecturer, Department of Mathematics, College of Science University of Salahaddin.
- October 2002- September 2005: Assistant Lecturer, Department of Mathematics, College of Science University of Salahaddin.
- October 2000 – August 2002 (Iraq): M.Sc. student and teaching assistant, Department of Mathematics, College of Science University of Salahaddin.

## Administration { Committees (Salahaddin University-College of Science)

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- January 2024- July 2024: Member of final examination committee of M.Sc. and PhD. of the College of Science, University of Salahaddin,
- September 2023- September 2024: Member of the Scientific and Higher study committee of the Department of Mathematics. College of Science, University of Salahaddin,
- Sept. 2014: Member of the final examination committee of B.Sc. of the college of Science, University of Salahaddin,
- Sept. 2015: Member of the final examination committee of B.Sc. of the college of Science, University of Salahaddin,
- October 2002-June 2008: Deputy Head of Department of Mathematics, College of Science, University of Salahaddin,
- 2002-2008: Member of the Scientific and Higher study committee of the department of Mathematics. college of Science, University of Salahaddin,
- Sept. 2008: Member of the final examination committee of B.Sc students of the college of Science, University of Salahaddin,
- Sept. 2007: Member of the final examination committee of M.Sc and Ph.D students of the College of Science, University of Salahaddin,
- 2002-2006: Member of the final examination committee of B.Sc students of the college of Science, University of Salahaddin,
- 2002-2008: A member in most committees in the Salahaddin University, especially in the college of Science

## Editorial Board

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- Jul. 2023- present: Section Editor, for the Zanko Journal of Pure and Applied Science.

## Qualifications

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- 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 of Sciences.
- 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 Science.

## Publications

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### Books

- Ahmed Muhammad and Hardi Nabe, Advanced Calculus, Salahaddin University Press, Salahaddin 2023. ISBN: 978-9922-21-430-6

### Journal Article

- A. Muhammad and W. Hammad, Computing c-numerical range of differential operator, Journal of Filomat 38:77(2024), 2243-2225.
- 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.
- A. Muhammad, B. Azeez, and F. Taheri, Computing the S-numerical range of differential operators, Journal of Operator and Matrices 17 (2023), 583-598.
- A. Muhammad, Approximation of numerical range of polynomial operators. Journal of Operator

- A. Muhammad and F. Shareef, Computing the  $q$ -numerical range of differential operators, Journal of Applied Mathematics Volume 2020, Article ID 6584805, 12 pages, (2020).
- A. Muhammad and F. Shareef, A numerical investigation of  $q$ -numerical range of operator matrices. Far east Journal of mathematical science 125 (2020), 1-33.
- W. Jalal and A. Muhammad, Elliptic numerical range of matrices. International mathematical Forum 15 (2020), 293-315.
- B. Azeez and A. Muhammad, Some results on  $S$ -numerical range of operator matrices. Zanko Journal of pure and Applied science 32 (2020), 57-63.
- A. Muhammad and W. Jalal, A numerical investigation of the  $c$ -numerical range of differential operator. Bulletin of Iranian mathematical society 45 (2019), 1755-1775.
- A. Muhammad and M. Marletta, A numerical investigation of the quadratic numerical range of Hain-L<sup>u</sup> operator. International Journal of Computer Mathematics 90 (2013), 2431-2451.
- A. Muhammad and M. Marletta, Approximation of quadratic numerical range of block operator matrices. Integral Equation and Operator Theory 74 (2012), 151-162.
- A. Muhammad and M. Marletta, Computation of boundary of quadratic numerical range (Approved to be published).
- A. Muhammad, Joint Numerical Range of matrix polynomials. Al-Rafiden Journal of Computer Science and Mathematics, Vol.6 No.2 (2009), p.129-136.
- 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.
- 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.

- 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

### Teaching experience:

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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.
- 2024- 2025: Assistance professor, Department of Mathematics- College of Science, University of Salahaddin, Erbil-Iraq.  
**Teaching Courses:** Complex Analysis, Functional Analysis.

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 I ( first semester- Master )
- 2023- 2024: Assistance professor, Department of Mathematics- College of Basic Education , University of Salahaddin, Erbil-Iraq.  
**Teaching Courses:** Functional Analysis( first semester- Diploma students )
- 2023- 2024: Assistance professor, Department of Mathematics- College of Science, University

of Salahaddin, Erbil-Iraq.

**Teaching Courses:** 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)

- 2023- 2024: Visiting Lecturer, Department of Mathematics- College of Science, Koya University .

**Teaching Courses:** , 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 PhD Thesis at University Sains Malaysia

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- 2021-present Amer Muhammad Salman, Ph.D.,

**Institution:** School of Mathematical Sciences Universiti Sains Malaysia.(co-advised with Mohd Haz Mohd)

**Thesis title:** On Stability analysis

### Supervision of Master Theses at Salahaddin University

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- 2024-present Rawaz Hassan Maoulod, M.Sc.

**Institution:** Department of Mathematic- College of Science, Salahaddin University- Erbil, Iraq

**Thesis title:** Computing numerical range for unbounded operator linear pencil

- September 2021-December 2022 Darawan Zrar Muhammad, M.Sc.

**Institution:** Department of Mathematic- College of Science, Salahaddin University- Erbil, Iraq

**Thesis title:** S-numerical range of polynomial operator Matrices.

- September 2015- December 2016: Fiza Abdullah Shareef, M.Sc

**Institution:** Department of Mathematic- College of Science, Salahaddin University- Erbil, Iraq

**Thesis title:** Approximation of q-numerical range of operator Matrices with applications.

## Supervision of PhD Thesis and Master Theses at Soran University

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- 2024-present Walat Jalal Hamad, Ph.D

**Institution:** Department of Mathematic- Faculty of Science, Soran University.

**Thesis title:** Computing quadratic numerical range and block numerical range of polynomial differential operators.

- September 2016-April 2017 Walat Jalal Hamad, M.Sc.

**Institution:** Department of Mathematic- Faculty of Science, Soran University.

**Thesis title:** Approximation of generalized numerical range of operator matrices with applications

## Supervision of Master Thesis at Koya University

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- September 2018-March 2019 Berivan Faris Aziz, M.Sc.

**Institution:** Department of Mathematic- Faculty of Science and Health-Koya University.

**Thesis title:** On the approximation of Krein space numerical range of operator matrices with applications

## Undergraduate research supervised at Salahaddin University

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Every academic year, I propose and supervise a selection of projects on various topics. If you are currently studying Mathematics at Salahaddin University and consider doing a project on a topic related to the Mathematics of Operator theory and spectral theory, please feel free to contact me.

- July 2014 Darawan Zrar Muhammad, B.Sc.

**Research titled:** Numerical range of matrix polynomial..

- July 2015 Sheren Abdulstar and Sheren Omer, B.Sc.

**Research titled:** A Review on the Lebesgue Spaces.

- July 2017 Chenar Abdulla Hassan and Redar Nadr Taha, B.Sc.

**Research titled:** Geometry of Numerical Range and S-Numerical Range of Operator Matrices.

- July 2017 Hozan Burhan and Hangaw Shakir, B.Sc.

**Research titled:** : Characterization of numerical range of matrix operator

- July 2018 Amer Mohammad Salman, B.Sc.

**Research titled:** Geometry of Numerical Range and Quadratic Numerical Range of Block Operator Matrices.

- July 2018 Sharmen Ghazi, B.Sc.

**Research titled:** Computing spectrum of finite dimensional operators.

- July 2019 Shayan Zeravan, B.Sc.

**Research titled:** Geometry of q-Numerical Range of Operator Matrices.

- July 2019 Bawan Rebwar, B.Sc.

**Research titled:** Some results on k-numerical range operators.

- July 2020 Abdulqadr Yasin Abdulla, B.Sc.

**Research titled:** Gershgorin discs versus numerical range.

- July 2021 Mustafa Fuad, B.Sc.

**Research titled:** Computing numerical range for 2 by 2 matrix polynomials.

- July 2021 Bahasht Mouhammad, B.Sc.

**Research titled:** A Note On Metric Equivalence Of Some Operator.

- July 2022 Hazar Adel and Ali Kalid, B.Sc.

**Research titled:** Application on Banach fixed point theorem.

- July 2023 Najeb Zuher, B.Sc.

**Research titled:** Computing numerical radius of operator matrices.

- July 2023 Huda Khalid, B.Sc.

**Research titled:** A study on Caputo fractional operator.

- July 2024 Ismail Syamand, B.Sc.

**Research titled:** Some properties and applications of fractional operators.

- July 2025 Juan Sarteb, B.Sc.

**Research titled:** Double sequence and double series

## School, Workshop and Conferences

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- 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.
- Workshop on the Bologna Process: Higher Education Reform and addressing Challenges , September 21, 2023.,Salahaddin University, Erbil-Iraq.
- Workshop on Algebra, Number theory and their applications to Cryptography. February 25 2024 to March 7, 2024 ,Salahaddin University, Erbil-Iraq.

- International Symposium on the reasons of the students weakness in mathematics . (PANALIST), May 13, 2024, Soran University- Faculty of Science-Department of Mathematics.
- The third International Conference on Research challenges and Recent Trends in Applied and Humanitarian Science, September 17,2023 Komar University of Science and Technology.
- Seventh Excellent paper symposium , November 16, 2024, Social Center of Salahaddin University-Erbil.
- Seventh International Conference of Applied Science, Energy and environment (TICMA2022), January 28th-29t, 2025, Tishk University collaboration with Salahaddin University, Erbil-Iraq.
- Seventh International Conference on Applied Science, Energy, and Environment. Erbil, Kurdistan Region-Iraq, January 28-30, 2025
- Rowing Through Numbers: Celebrating Francesco Pappalardis 60th birthday. May 18-19,..,2025, Salahaddin University, Erbil-Iraq.
- Fourth International Conference of Mathematics and Applications (TICMA2022), May 22-23.,2025, Salahaddin University, Erbil-Iraq.

### **Courses attended**

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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**

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Ministry of Higher Education and Scientific Research, Research Programs, PhD studies in Cardiff School of Mathematics- Cardiff University- UK, 2009- 2013