

## CURRICULUM VITAE FOR AHMED MUHAMMAD

Department of Mathematics  
College of Science  
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### Education

2008–2012	Doctor of Philosophy, Mathematics, School of Mathematics, Cardiff University, UK Thesis title: <i>Approximation of Quadratic Numerical Range of Block Operator Matrices.</i>
2000–2002	Master of Science, Mathematics, Department of Mathematics, College of Science, Salahaddin University, Iraq Thesis title: <i>Some generalizations of Numerical Range of operators on a complex Hilbert.</i>
1993–1997	Bachelor of Science, Mathematics, Department of Mathematics, College of Science, Salahaddin University, Iraq

### Research interests

My research lie 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-Lüst 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.

### Positions

- 9/2012-present: Lecturer, Department of Mathematics, College of Science, University of Salahaddin.
- 10/2008-04/2012: PhD student, 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.
- 09/1996-09/2000: Teaching Assistant, Department of Mathematics, College of Science, University of Salahaddin.

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

- 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.
- 2007 : Member of final examination committee of M.Sc and PhD. of the college.
- 2008 : Member of final examination committee of B.Sc of the college.
- 2014 : Member of final examination committee of B.Sc of the college.
- 2015: Member of the Budget Committee, College of Sciences.
- 2016: Member of thesisgate group. <http://thesisgate.com/advisory-board-members/>
- 2017: Member of thesisgate group. <http://thesisgate.com/advisory-board-members/>
- A member in most comities in the Salahaddin University, especially in the college of Science.

### Teaching Experience

I have taught a variety of undergraduate courses in calculus, multivariable 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, as well as graduate courses in spectral theory, operator theory and functional 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 under supervision Professor Marco Marletta.
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 Science, University of Salahaddin, Erbil, Iraq.
Teaching Courses	Fundamental of Mathematics, functional analysis I, and functional analysis II (post-graduate student).
2014–2015	Lecturer, Department of Mathematics- College of Science, University of Salahaddin, Erbil, Iraq.
Teaching Courses	Fundamental of Mathematics, advanced calculus.
2014–2015	Visiting Lecturer, Department of Mathematics- Faculty of Science, Soran University.
Teaching Courses	Functional analysis (postgraduate student).
2015–2016	Lecturer, Department of Mathematics- College of Science, University of Salahaddin, Erbil, Iraq.
Teaching Courses	Foundation of Mathematics.
2015–2016	Visiting Lecturer, Department of Mathematics- College of Science, Koya University.
Teaching Courses	Mathematical Analysis.
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.
2017–2018	Visiting Lecturer, Department of Mathematics- College of Science, Koya University.
Teaching Courses	Operator theory (postgraduate students).

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.
2020–2021	Visiting Lecturer, Department of Mathematics- College of Science, Koya University.
Teaching Courses	Operator theory + Functional Analysis (postgraduate students-first semester).
2020–2021	Visiting Lecturer, Department of Mathematics- College of Science, University of Sulaimani.
Teaching Courses	Spectral theory (postgraduate students- second semester).

### Supervision of Master theses

- 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.

### Books

- Ahmed Muhammad and Hardi Nabe, Advanced Calculus 2017-2018.
- 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.

### Publications

### Publications in print

- A. Muhammad, Approximation of numerical range of polynomial operators. *Journal of Operator and Matrices*. (2021)
- A. Muhammad and F. Shareef, Computing the  $q$ -numerical range of differential operators. *Hindawi Journal of Applied Mathematics* (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-Lüst 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

### Presentations in Seminars

- Spectral theory, Quantum Chaos and Random Matrices Cardiff, June 29th July 1st, 2009. Location: Cardiff school of mathematics UK.
- Spectral theory, Quantum Chaos and Random Matrices Cardiff, June 29th July 1st, 2010. Location: Cardiff school of mathematics UK.
- Boundary value problem. In Jun 2013, the second Iraqi-French Conference in Mathematics. Location: Salahaddin University-College of Science-Department of Mathematics.