



Professor Doctor

## Prof. Dr. Eman Samir Bhaya

Dean

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### Academic Degree

**Academic Degree:** PhD

**Granting University:** Baghdad University

**General Specialization:** Mathematics

**Exact Specialization:** Functional Approximation Theoryul

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### Scientific Research, Books & Publications

- 1- A study on approximations of bounded measurable functions with some discrete series in  $L_p$  spaces  $p < 1$ , M.Sc. thesis, Baghdad University (2000).
- 2- Operators for best approximation and best one sided approximation in  $L_p$ ,  $p < 1$ , Babylon University Journal for pure and applied mathematics, vol10, number 3, 723-727, (2005).
- 3- One sided approximation and saturation problem for some trigonometric operators in  $L_p$ ,  $p > 0$ , Babylon University Journal for pure and applied mathematics, vol9, number 3, 847-852, (2004).
- 4- A characterization of the best and best one sided algebraic approximation in  $L_p[0,1]$  ( $0 < p$ ) Babylon University Journal for pure and applied mathematics, vol 10, number 3, 2005., 749-750.
- 5- Convergence of periodic functions by interpolating polynomials, Babylon University Journal for pure and applied mathematics, vol 7, number 3, 2002., 967-974.
- 6- Approximation of positive and monotone functions, Journal of College of Education, Al Mustanseria University, vol.7, 8- 16,(2002).
- 7- Direct and inverse theorems for best multi-approximation in  $L_p$ ,  $p > 1$ , Maths and Physics J. vol. 17 (5),1-8, (2002).
- 8- On the constrained and unconstrained approximation, Ph.D. thesis, Baghdad University(2003).
- 9- Orders of coapproximation of functions by algebraic polynomials, Al- Qadysia Journal for pure science-vol.9, no.1, 338-345.(2004).
- 11- Weak copositive approximation and Whitney theorem in  $L_p$ ,  $p < 1$ , Jordan Journal of applied science , Natural science, vol.8,no.2,51-58, (2006).
- 12- Simultaneous convex polynomial and spline approximation, Journal of Babylon University for pure and applied sciences, vol.13, no. 3, 1045-1051. (2006).
- 13- Almost copositive polynomial approximation in  $L_p[-1,1]$ ,  $p < 1$  The first conference on mathematical sciences (2006), Zarqa private

University Jordan 52-57..

14- Asymptotic behavior of derivatives of near best approximation polynomials, J. Basah Research (sciences), vol. 33, no.3, 54-59.sep (2007).(2005)

15- Approximation of 3-monotone functions by 3-monotone functions in  $L_p$  spaces. The second scientific conference in Kufa University(2009).

16- A saturation theorem and negative theorem for monotone approximation. Journal of College of Education, Babylon University, for the second scientific conference vol.3.10- 14.(2008).

17-  $L_{p,p<1}$  Polynomial approximation on Cube. Uruk Journal,vol1.141-146,( papers of the first scientific conference in College of science Al Muthana University9-10 October(2007).

18-  $L_{p,p<1}$  Polynomial approximation on Cube. Uruk Journal,vol1.141-146,( papers of the first scientific conference in College of science Al Muthana University9-10 October(2007).

19- Estimates for comonotone polynomial approximation in  $L_p$ .

The second conference of Mathematical science (CMS 2008), Zarqa private University Jordan 438-444.

20- Inverse and direct theorems for monotone approximation The first scientific conference for pure and applied sciences12-13 March (2008). 180-175. Kufa University.

21- Interpolating operators for multi approximation. Journal of mathematics and statistics. 6(3):2333-239,2010.USA.

22- Probability and Functional analysis , Babylon Journal for natural sciences, a special volume for the papers of the first scientific conference for college of education Babylon University, 17-18 February vol.2, 72-77.(2007).

23- A normed Orlices Classes and Spaces, Babylon Journal for natural sciences, a special volume for the papers of the first scientific conference for college of education Babylon University, 17-18 February vol.2, 85-87.(2007).

24- One-sided and co-onesided approximation, European Journal of Scientific Research, vol44, Issue 2.

25- Coconvex polynomial approximation42-57,(2009) . Journal of Al- Qadysia for mathematics and computer sciences, A special volume for The first scientific conference for mathematics and computer science, Al Qadisia University 27-28, August , 2008.

26- Direct estimation for multivariate polynomial approximation. J. of Kerbala University, Scientific Journal vol.5, no.2, 136-142, (2007).

27- The rate of co approximation of monotone functions in  $L_p$ ,  $p<1$ . Al Kufa Journal . ISSN 1994-2168, vol. 8, no.1, 2007, 30-46.

28- Convex approximation by polynomials and piecewise polynomials (KAJ) Kurdistan Academicians Journal, March, (2007), 5(1) part A, 103-108.

29- On  $k$ -monotone approximation in  $L_p$  Journal of Kufa for Mathematics and Computer Faculty of Mathematics and Computer Sciences. Issn. 2076-1171.vol. 1,no.1p. 54-64.

30- Free knot spline approximation of  $k$ -monotone functions for feed forward neural networks. Australian Journal of Basic and Applied Sciences, 2966- AJBAS 12-8-2010.

31. A saturation and inverse theorem for co positive approximation in  $L_p$  for  $0<p<1$ . Accepted in the Journal of Babylon University, 978,8-8-2010.

32. On Lorentz space. Introduced to the Journal of Babylon University. 2010

33. Orders of co approximations of functions by polynomials. The third conference of Mathematical science (CMS 2010), Zarqa private University Jordan 600-605.

34. On Jackson's theorem. International Journal of Science and Technology, vo. 1, no. 6, 2011.
35. A modulus of smoothness in terms of fractional order. International Journal of Contemporary Mathematical Sciences. Vol. 7. No. 37. Pp. 1807-1817. 2012.
36. Estimates in terms of partial moduli of smoothness. International Journal of Contemporary Mathematical Sciences. Vol. 7. No. 37. Pp. 1819-1829.
37. Positivity Preserving Multiapproximation. American Journal of Scientific and industrial research 3(6), 2012.
38. Simultaneous approximation by complex polynomial. Int. Journal of Mathematical analysis. Vol. 7, no. 36, 1803-1808, 2013. IF. 0.2
39. Stability and density of periodic points of  $L_p$  spaces,  $0 < p < 1$ . Int. Journal of Mathematical analysis. Vol. 7, no. 34, 1673-1684, 2013. IF. 0.2.
40. Results on comonotone approximation. The Int. Journal of mathematical Archive, 2013, Icv. 5.09.234-242, 4(7), 2013.
41. Some results on comonotone approximation. Accepted in Journal of Babylon University, 2013.
42. التنمية المستدامة. و ينشر في مجلة اتحاد الجامعات العربية / كلية الهندسة / جامعة بغداد 42.
43. Some properties of semi dynamical system generated by Von Forester Losata type. 7(38), 1863-1868.
44. Complex operators for complex approximation. Ijma. Info 4(81), 2013, 1-10.
45. Estimates for approximation of 3-monotone functions. Ijma. Info. 5910), 2014, 1-5.
46. Converse result on copositive approximation in  $(C, \|\cdot\|_p)$ ,  $0 < p < 1$ . International research journal of Scientific findings 1(6), 229-236.
47. Coconvex approximation of unbounded function in  $L_p$  spaces II. International research journal of Scientific findings. 1(4), 153-162. 2014.
48. Coconvex approximation of unbounded function in  $L_p$  spaces. International research journal of Scientific findings. 1(3), 0087-0098. 2014.
49. Simultaneous monotone multiapproximation. International journal of mathematical analysis. 8(24). 1169-1177. 2014.
50. Negative theorem for monotone bivariate approximation. International journal of mathematical analysis. 8(24). 1179-1185.
51. Piecewise 3-monotone approximation on  $L_p$ -spaces for  $0 < p < 1$ . International research journal of Scientific findings. 1(4), 153-162. 2014.
52. Degree of Approximation by Taylor Operator of Functions in  $(C, \|\cdot\|_p)$  Space. for  $0 < p < 1$ . Accepted in the journal of Babylon University, may, 2015. v.24, no. 3, 2016.
53. Equivalence between  $K$ -functional and  $r$ -th modulus of smoothness for neural networks. Accepted in the journal of Babylon University, may, 2015.
54.  $L_p$  direct theorem for exponential neural networks. Accepted in the University of Babylon journal, in 14-6-2015, and will published in v. 24, n. 4 in 2016.

55. Nearly exponential approximation for neural networks. Journal of University of Babylon. N. 1, vol. 26,2018.
56. Spherical approximation on unit sphere. Journal of Babylon University. V26,n2,2018. To appear.
57. The essential order of  $L_p, p < 1$  approximation using regular neural network. . Journal of Babylon University. V26,n1,2018, to appear.
58. on the mixed  $r$ th modulus of smoothness. Journal of Babylon University. V26,n1,2018, to appear.
59.  $L_p, p < 1$  Approximation Using Radial Basis Function Neural Networks on Ordered Vector Space.
60. On monotone rational approximation. Journal of Babylon University Pure and Applied Sciences. N. 1, vol. 26m 2018.
61. Jacobi Weighted Moduli of Smoothness for Approximation by Neural Networks Approximation. Journals of University of Babylon. V27, n. 2019.
62. A new modulus of smoothness for uniform approximation. Journals of University of Babylon. V26, N.8, 2018.
63. A new modulus of smoothness of  $k$  monotone functions in  $L_p$  spaces for  $p < 1$  . Journal of Engineering and Applied Sciences, issn,1816-949X, v. 14, n. 12-13, Jun 2019.
64. Whitney Multiapproximation> journal of University of Babylon for Pure and Applied Sciences, vol26, no7, 2018.
65. Constructive Approach of Neural Network Approximation of Trigonometric Activation Function. Journal of Engineering and Applied Sciences. Vol.15, no 1.
66. Stechin Marchaud inequality in terms of Neural Networks Approximation in  $L_p$  spaces for  $0 < p < 1$ . 2nd international conference of Kerbala University, College of Education for Pure Sciences.
67.  $L_p$  Approximation of Functions on Graphs. الدولي المؤتمر وقائع في نشر  
الرابع حول معامل التأثير العربي 21-24 يونيو 2019
68. Approximation of functions in  $L_p$  spaces for  $p < 1$ , using radial basis function neural networks. J of University of Babylon for Pure and applied Sciences, v.27, n.3, 2019.
69. Best Neural Simultaneous Approximation 2-normed  $L_p$  spaces, Indonesian Journal of Electrical Engineering and Computer Science, v.14, n. 2, 2019, issn. 2502-4752.
72. Sobolev Inequalities for Functions on Graphs, [Bhaya, ES, Flaih, Z. Journal of Physics: Conference Series](#)[this link is disabled](#), 2021, 1804(1), 012132
- 73 . Approximation of fourier series in terms of functions in  $L_p$  spaces for  $0 < p < 1$   
[Aboud, SM, Bhaya, ES International Journal of Nonlinear Analysis and Application](#)[this link is disabled](#), 2021, 12(2), pages 897–911
74. Sobolev Inequalities for Functions on Graphs [Bhaya, ES, Flaih, Z. Journal of Physics: Conference Series](#)[this link is disabled](#), 2021, 1804(1), 012132
75. Nearly Monotone Neural Approximation with Quadratic Activation Function [Almurieb, HA, Bhaya, ES Journal of Physics: Conference Series](#)[this link is disabled](#), 2021, 1804(1), 012098

76. Moduli of Smoothness for Weighted  $L_p$ ,  $0 < p < 1$  Approximation [Sharba, ZA, Bhaya, ES Journal of Physics: Conference Series this link is disabled](#), 2021, 1804(1), 012081
77. Best neural simultaneous approximation [Almurieb, HA, Bhaya, ES Indonesian Journal of Electrical Engineering and Computer Science this link is disabled](#), 2020, 20(3), pages 1584–1590
78.  $L_p$ ,  $\infty > p \geq 1$  Simultaneous Approximation [Bhaya, ES, Abdoul Khaleq, AH IOP Conference Series: Materials Science and Engineering this link is disabled](#), 2020, 928(4), 042001
79. Trigonometric Neural Networks  $L_p$ ,  $p < 1$  Approximation [Bhaya, ES, Abd Al-Sadaa, ZH Journal of Physics: Conference Series this link is disabled](#), 2020, 1591(1), 012060
80. SoftMax Neural Best Approximation [Almurieb, HA, Bhaya, ES IOP Conference Series: Materials Science and Engineering this link is disabled](#), 2020, 871(1), 012040
81.  $L_p$  approximation by ReLU neural networks [Bhaya, ES, Sharba, ZA Karbala International Journal of Modern Science this link is disabled](#), 2020, 6(4), pages 414–419
82. Finite fourier coefficients is best approximation to  $f \in L(P, \mu)$  [Kazem, HN, Bhaya, ES Journal of Advanced Research in Dynamical and Control System this link is disabled](#), 2020, 12(5), pages 193–199
83.  , APPROXIMATION OF FUNCTIONS ON GRAPHS Abdul Jalil M. Khalaf and Eman S Bhaya, Jour of Adv Research in Dynamical & Control Systems, Vol. 11, 10–Special Issue, 2019
84. Monotone Approximation by Quadratic Neural Network of Functions in  $L_p$  Spaces for  $p < 1$ , Iraqi Journal of Science, 2020, Vol. 61, No. 4, pp: 870–874 DOI: 10.24996/ijs.2020.61.4.20.
85. Does Math Destroyed the Jurassic Park? Journal of University of Babylon for Pure and Applied Sciences, Vol. (28), No. (3): 2020 Online ISSN: 2312-8135, Print ISSN: 1992-0652.
86. Best neural simultaneous approximation. Indonesian Journal of Electrical Engineering and Computer Science Vol. 20, No. 3, December 2020, pp. 1584~1590 ISSN: 2502-4752, DOI: 10.11591/ijeecs.v20.i3.pp1584-1590.
87.  $L_p$ ,  $\infty > p \geq 1$  Simultaneous Approximation. 2nd International Scientific Conference of Al-Ayen University (ISCAU-2020) IOP Conf. Series: Materials Science and Engineering 928 (2020) 042001 IOP Publishing doi:10.1088/1757-899X/928/4/042001.
88. Trigonometric Neural Networks  $L_p$ ,  $p < 1$ . FISCAS 2020 Journal of Physics: Conference Series 1591 (2020) 012060 IOP Publishing doi:10.1088/1742-6596/1591/1/012060.
89. Sobolev Inequalities for Functions on Graphs. ICMAICT 2020 Journal of Physics: Conference Series 1804 (2021) 012132 IOP Publishing doi:10.1088/1742-6596/1804/1/012132.
90.  $L_p$  Appr  $L_p$  Approximation by ReLU Neural Networks. Karbala International Journal of Modern Science: Vol. 6 : Iss. 4 ,

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91. Moduli of Smoothness for Weighted  $L_p, 0 < p < 1$  Approximation. ICMAICT 2020 Journal of Physics: Conference Series 1804 (2021) 012081 IOP Publishing doi:10.1088/1742-6596/1804/1/012081.

92. Finite Fourier Coefficients is Best Approximation to  $f$ . Jour of Adv Research in Dynamical & Control Systems, Vol. 12, No. 5, 2020.

93. A Look at Sobolev Spaces on Graphs. 2nd International Scientific Conference of Al-Ayen University (ISCAU-2020) IOP Conf. Series: Materials Science and Engineering 928 (2020) 042011 IOP Publishing doi:10.1088/1757-899X/928/4/042011.

94. Nearly Monotone Neural Approximation with Quadratic Activation Function. ICMAICT 2020 Journal of Physics: Conference Series 1804 (2021) 012098 IOP Publishing doi:10.1088/1742-6596/1804/1/012098.

95. SoftMax Neural Best Approximation. The First International Conference of Pure and Engineering Sciences (ICPES2020) IOP Conf. Series: Materials Science and Engineering 871 (2020) 012040 IOP Publishing doi:10.1088/1757-899X/871/1/012040.

96. Degree of best approximation in terms of weighted DT moduli of smoothness. Doi: 10.5373/JARDCSI/V1214/20201419.

97. Shape preserving approximation using convex smooth piecewise polynomials for functions in  $L_p$  quasi normed spaces. Int. J. Nonlinear Anal. Appl. 13 (2022) 1, 3363-3370 ISSN: 2008-6822 (electronic) <http://dx.doi.org/10.22075/ijnaa.2022.6096>.

98. "Piecewise Convex  $L_p, 0 < p < 1$ . 1st International Conference on Advanced Research in Pure and Applied Science", which will be held at College of Science / Al- Muthanna

University, Iraq during 24-25 March, 2021. Your paper will be published online by AIP Conference Proceedings (ISSN: 0094-243X).

99. . VDUNKL WEIGTED INVERS THEOREMS APPROXMATI OF FUNCTIONES.

NeuroQuantology.

100. A Modified Ostrowski Inequality with Random Variable Application on  $L_p [a, b], 0 < p < 1$ , Spaces. International Journal of Mechanical Engineering. ISSN: 0974-5823 Vol. 7 No. 3 March, 2022.

101. Approximation of Expectation and Variance on  $[ , ]$  Interval, with Probability Density Function in  $[ , ]$ ,  $0 < < 1$ . ISSN: 0974-5823 Vol. 7 No. 3 March, 2022 International Journal of Mechanical Engineering.

102. An application of a modified Chebyshev inequality. Conference AIP. 2022

103. Inequalities for Expectation, Variance and Dispersion. AIP conference Proceeding.2022

104. Saturation Problems for Positive Linear Approximation of Function in Quasi Normed spaces. n International Journal of Health Sciences (IJHS). 2022. 6(S3), 12070-12077.

105. COLINEAR APPROXIMATION IN TERMS OF GENERALIZAL WEIGHTED MODULUS OF

SMOOTHNESS IN  $L_p$  SPACES. ISSN: 0974-5823 Vol. 7 No. 2 February, 2022 International Journal of Mechanical Engineering.

106. Ditzain-Totik modulus of smoothness for the fractional derivative of functions in  $L_p$  space of the partial neural network. Int. J. Nonlinear

Anal. Appl. 13 (2022) 1, 3305-3317 ISSN: 2008-6822 (electronic)

107. Weighted approximation using neural network in terms of fractional modulus of smoothness of fractional derivative. Int. J. Nonlinear Anal. Appl. 13 (2022) 1, 3381-3394 ISSN: 2008-6822 (electronic)