Muwaffaq Irsheid Alomoush, Ph.D.

Professor of Electrical Power Engineering
The Department of Electrical Power Engineering
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PERSONAL DATA

Date of Birth : January 24, 1967
Place of Birth : Al-Mafraq, Jordan
Nationality : Jordanian
Sex : Male
Marital Status : Married with four children

EDUCATION

Ph.D., Electrical Engineering, 2000
Illinois Institute of Technology (IIT), Chicago, Illinois, USA.
Dissertation Title: Auctionable Fixed Transmission Rights for Congestion Management

M.Sc., Electrical Power Engineering, 1994
Jordan University of Science and Technology, Irbid, Jordan
Thesis: Switching Operations Impact on the Transient Behavior of Large Induction Motors

B.Sc., Electrical Engineering – Power Engineering, 1990
Jordan University of Science and Technology, Irbid, Jordan

FIELDS OF INTEREST

Electrical Power Systems: restructuring, economics, control, optimization and decision-making, congestion management, transmission rights, and security.
FACTS devices: modeling, control and usage of FACTS in restructured environment and for power system stability purposes.

PROFESSIONAL EXPERIENCE

- **Yarmouk University**, Hijjawi Faculty of Engineering Technology, Department, (Irbid, Jordan), September 2015-Now, ***Professor***.
- **Al Albayt University**, (Mafraq, Jordan), August 2012-September 2015, ***Vice President for Scientific Faculties and Institutes***.
- **Yarmouk University**, Hijjawi Faculty of Engineering Technology, Department, (Irbid, Jordan), July 2011-August 2012, ***Professor*** and ***Dean***.

- **Yarmouk University**, Hijjawi Faculty of Engineering Technology, (Irbid, Jordan), September 2010–July 2011, ***Associate Professo****r* and ***Dean***.
- **Yarmouk University**, Hijjawi Faculty of Engineering Technology, (Irbid, Jordan), August 2008–August 2010, ***Associate Professo****r* ***and Vice Dean***.
- **German-Jordanian University**, Department of Energy, (Amman Jordan), September 2007–August 2008, ***Associate Professo****r* (***Sabbatical Leave***).
- **Yarmouk University**, Department of Electrical Power Engineering, (Irbid, Jordan), December 2004–September 2007, ***Associate Professor***.
- **Yarmouk University**, Department of Electrical Power Engineering, (Irbid, Jordan), June 2000–December 2004, ***Assistant Professor***
- **Illinois Institute of Technology**, Electrical and Computer Engineering Dept., (Chicago, Illinois, USA), 1999–2000, ***Post-doctoral Visiting Scholar***
- **Illinois Institute of Technology**, Electrical and Computer Engineering Dept., (Chicago, Illinois, USA), 1996–1999, ***Research Assistant***
  Topic: Deregulated (Restructured) Power Systems
  Fields of Knowledge: Congestion Management, Power Markets, Energy Management Systems, Energy Trading, Power System Security, Risk Management
- **Yarmouk University**, Department of Electrical Power Engineering. (Irbid, Jordan), 1993–1996, ***Instructor*** :
  Electrical Machines Labs, Measurements Lab, Electrical Circuits, Engineering Mathematics.
- **Jordan University of Science and Technology, Electrical Engineering Dept. (Irbid, Jordan), 1991–1993, *Teaching Assistant:***
  Power Systems, Electrical Machines (AC and DC) and Circuits Labs

ACADEMIC AWARDS AND HONORS

- The Hisham Hijjawi ***Academic Distinction Award in the Field of Teaching***, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2003.
- The Hisham Hijjawi ***Academic Distinction Award in the Field of Scientific Reasearch*** for publications in The IEEE Journals, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2003.
- Graduate Research Assistantship, Illinois Institute of Technology, 1997-2000.
- PhD scholarship from Yarmouk University, 1997-2000.
- Graduate Teaching Assistantship granted by Jordan University of Science and Technology, 1991-1993.
- Ranked First in Tawjihi (the General Secondary Certificate Examination) in the Municipality of Al-Mafraq, for the year 1985.

PUBLICATIONS

Book

1. M. Shahidehpour and M. Alomoush, *Restructured Electrical Power Systems: Operation, Trading and Volatility*, Marcel Dekker Inc., New York, USA, 2001.

Book Chapter

2. M. Shahidehpour and **M. Alomoush**, "Decision Making in a Deregulated Power Environment Based on Fuzzy Sets," Book chapter, *Modern Optimization Techniques in Electric Power*, Kluwer Publishers, 1999.
3. **M. Alomoush** and M. Shahidehpour, "Transmission Congestion Management and Pricing," Book Chapter, *Market Operations in Electric Power Systems: Forecasting, Scheduling, and Risk Management, John Wiley & Sons, NY, 2002, pp.369-453.*

Published Journal Papers

4. A. Shaltout and **M. Alomoush** "Reclosing Torques of Large Induction Motors with Stator Trapped Flux," *IEEE Transactions on Energy Conversion*, 11 (1), March 1996, pp. 84-91.
5. **M. Alomoush** and M. Shahidehpour, "Fixed Transmission Rights for Inter-Zonal and Intra-Zonal Congestion Management," *IEE Proc.-Generation, Transmission and Distribution*, 146 (5), Sept. 1999, pp. 471-476.
6. **M. Alomoush** and S. M. Shahidehpour, "Generalized Model for Fixed Transmission Rights Auction." *Journal of Electric Power Systems Research*, 54 (3) (2000), pp. 207 - 220.
7. **M. Alomoush** and M. Shahidehpour, "Contingency-Constrained Congestion Management with a Minimum Number of Adjustments in Preferred Schedules," *Journal of Electric Power and Energy Systems*, 22 (4) (2000), pp. 277-290.
8. **M. Alomoush**, "Derivation of UPFC DC Load Flow Model with Examples of its Use in Restructured Power Systems," *IEEE Transactions on Power Systems*, 18 (3), 2003, 1173-1180.
9. **M. Alomoush**, "Exact Pi-Model of UPFC-Inserted Transmission Lines in Power Flow Studies," *IEEE Power Engineering Review*, December (2002) 54-56.
10. **M. Alomoush**, "Significance of Thyristor-Controlled Series Compensations in Restructured Power Systems," *International Journal of Power and Energy Systems, Special Issue on Blackouts*, 2004, 8-14.
11. **M. Alomoush**, "Impacts of UPFC on line flows and transmission usage," *Electric Power Systems Research*, 71 (3), 2004, 223-234.
12. **M. Alomoush**, "Performance Indices to Measure and Compare System Utilization and Congestion Severity of Different Dispatch Scenarios," *Electric Power Systems Research*, 74(2), 2005, 223-230
13. W. Abu-Elhaija, A. Al-Zaben and **M. Alomoush**, "Quantifying Severity of Unbalanced Conditions of Induction Motor Using Wavelet Entropy," *Electric Power Components and Systems*, 34 (9), 2006, pp. 1001-1013.
14. **M. Alomoush** and S. Albatran, "Simulink-Based Implementation of TCSC-Operated Single-Phase Induction Motor as an Educational Tool," *Computer Applications in Engineering Education*, 19(3), 2009, pp.514-524. https://doi.org/10.1002/cae.20332.
15. **M. Alomoush**, "Considering Line Status in The Dispatch Process to Minimize Transmission Congestion Cost and Maximize System Usage," *International Journal of Power and Energy Conversion*, 2 (1), 2010, pp. 1-15.

16. **M. Alomoush**, "Incorporating Voltage Stability Limit in Competitive Energy Market Optimal Dispatch," *Abhath Al-Yarmouk: Basic Sciences and Engineering*, 19 (1), 2010, pp.37-56.
17. **M. Alomoush**, "Fractional Calculus Based Optimal Controllers of Automatic Voltage Regulator in Power System," *Journal of Control and Intelligent Systems*, 38(1), 2010, pp.40-48.
18. **Muwaffaq I. Alomoush**, "Load frequency control and automatic generation control using fractional-order controllers," *Electrical Engineering*, 91(7), 2010, pp. 357–368.
19. **M. Alomoush**, "Modeling of Static Synchronous Series Compensator for Energy Markets Approximate Calculations," *Abhath Al-Yarmouk: Basic Sciences and Engineering*, 18 (2), 2009, pp. 153-166.
20. S. Abatran and **M. Alomoush**, "Modeling and Simulation of TCSC-Operated Single-Phase Induction Motor", *Journal of Electrical Systems*, Vol. 6, No. 1, 2010, pp.1-15.
21. **Muwaffaq I. Alomoush**, "Multicriteria selection of optimal location of TCSC in a competitive energy market," *Journal of Electrical Engineering*, Vol. 61, No. 3, 2010, pp. 129-140.
22. Ali Q. Al-Shetwi1, and **Muwaffaq I. Alomoush**, "A new approach to the solution of economic dispatch using genetic algorithm," *Journal of Engineering and Technology*, Vol. 7, 2016, pp. 63-79.
23. **Muwaffaq I. Alomoush** "Using bacterial foraging algorithm to design optimal power system stabilizer and comparisons with GA and PSO," *International Journal of Power and Energy Research*, Vol.1, No.1, 2017.
24. **Muwaffaq I. Alomoush**, "Concurrent optimal design of TCSC and PSS using symbiotic organisms search algorithm," *Turkish Journal of Electrical Engineering & Computer Sciences*, Vol. 25, pp. 3904 – 3919, 2017.
25. Issam A. Smadi, Saher Albatran, Mohammad Alathamneh, **Muwaffaq I. Alomoush**, "Security Constraint Economic Dispatch with Linear/Nonlinear Energy Storage System during Short-Term Emergency Period," *International Journal of Renewable Energy Research (IJRER)*, Vol. 11, No.1, pp. 129-140, 2017.
26. **Muwaffaq I. Alomoush**, and Zaid B. Oweis, "Environmental–Economic Dispatch Using Stochastic Fractal Search Algorithm," *International Transactions con Electrical Energy Systems*, 2018, https://doi.org/10.1002/etep.2530
27. Saher Albatran, **Muwaffaq I. Alomoush**, and Ahmed M. Koran, "Using Gravitational Search Algorithm for Optimal Controllers Design of Doubly-fed Induction Generator Driven by a Wind Turbine," *International Journal of Electrical and Computer Engineering (IJECE)*, Vol.8, No.2, pp. 780-792, 2018.
28. **Muwaffaq I. Alomoush**, "Optimal design of damping controllers in a power system including TCSC using gravitational search algorithm," *Mechatronic Systems and Control*, Vol. 17, No.1, 2019, http://dx.doi.org/10.2316/J.2019.201-2859.
29. **Muwaffaq I. Alomoush** and Abed-AL Rahman N. Hyasat, "Multi-Objective Economic and Emission Dispatch Using Symbiotic Organisms Search Algorithm," *International Journal of Power and Energy Systems*, Vol. 38, No.1, 2018, http://dx.doi.org/10.2316/Journal.203.2018.1.203-6324.
30. **Muwaffaq I. Alomoush**, "Microgrid combined power-heat economic-emission dispatch considering stochastic renewable energy resources, power purchase and emission tax," *Energy Conversion and Management*, Vo.200, 2019, https://doi.org/10.1016/j.enconman.2019.112090
31. Muwaffaq I. Alomoush, "Application of the stochastic fractal search algorithm and compromise programming to combined heat and power economic–emission dispatch," *Engineering Optimization*, 2019. https://doi.org/10.1080/0305215X.2019.1690650.

32. **Muwaffaq I. Alomoush**, "Complex power economic dispatch with improved loss coefficients," *Energy Systems*, 2019, https://doi.org/10.1007/s12667-019-00370-y

Published Conference Papers

33. **M. Alomoush** and M. Shahidehpour, "Exact Extension of Contingency Area using Successive Solutions and Distribution Factors," in Proceedings of the 1999 American Power Conference, Chicago, IL, Apr.1999.
34. **M. Alomoush** and M. Shahidehpour, "Decision in a Deregulated Power Environment Based on Fuzzy Approach," in Proceedings of the 1998 Large Engineering Systems Conference on Power Engineering, Nova Scotia, Canada, June 1998, pp. 305-310.
35. A. Shaltout and **M. Alomoush** "Circuit Breaker Simulation for Induction Motor Transient Calculations," presented at a Conference on Computational Aspects and Their Applications in Electrical Engineering, May 21-23, 1995, Amman, Jordan.
36. **M. Alomoush** and M. Shahidehpour, "Impact of Wheeling Transactions on Zonal Congestion with FTR," in Proceedings of the 1999 Large Engineering Systems Conference on Power Engineering, Nova Scotia, Canada, June 1999, pp.231-236.
37. **M. Alomoush**, "Static Synchronous Series Compensator to Help Energy Markets Resolve Congestion-Caused Problems," accepted for presentation and publication in the Proceedings of the 2004 Large Engineering Systems Conference on Power Engineering, Nova Scotia, Canada, July, 2004.
38. **M. Alomoush**, "Using Performance Indices and Analytic Hierarchy Process to Select Best Dispatch Option of Energy Markets," Proceedings of the 39th International Universities Power Engineering Conference (UPEC2004), 6th – 8th September 2004, UWE Bristol, UK.
39. Awad Al-Zaben, Wejdan Abu-Elhaija, **Muwaffaq Alomoush**, "Identification of Three Phase Transformer Abnormal Conditions Using Wavelet Entropy," Proceedings of the IEEE International Electric Machines and Drives Conference, 2007 (IEMDC '07) , 3-5 May 2007, Antalya, Turkey, Vol. 2, pp.1529 – 1533.
40. **Muwaffaq I. Alomoush**, "Multicriteria Optimal Location of TCPAR in a Competitive Energy Market Using ELECTRE III," Proceedings of the 44th International Universities' Power Engineering Conference (UPEC2009), 1st-4th september 2009, Glasgow, Sctotland.
41. **Muwaffaq I. Alomoush**, "Coordinated Tuning of IPFC and PSS to Improve Power System Stability Using BFO" Accepted in the 45th International Universities Power Engineering Conference (UPEC 2010), Cardiff, Wales UK.
42. Khaled Nusair, and **Muwaffaq I. Alomoush**, "Optimal Power Flow Solution of Power System Incorporating Wind Farm Using Whale Optimization Algorithm," The 8th International Renewable Energy Congress (IREC 2017), Amman, 21-23 March, 2017.
43. Khaled Nusair, and **Muwaffaq I. Alomoush**, "Optimal reactive power dispatch including wind farm using Grey Wolf Optimization algorithm," Integration of Renewable Energy Into High voltage systems conference & Exhibition, CIGRE-Jordan, Amman, 26 – 27 April, 2016.
44. Khaled Nusair, and **Muwaffaq I. Alomoush**, "Optimal power flow using Multi-Verse Optimizer Algorithm," The 10th Jordanian International Electrical & Electronics Engineering Conference (JIEEEC 2017), Amman, 16 – 17, May, 2017.

45. Ali B. Othman and **Muwaffaq I. Alomoush**, "Optimal Location and Parameters of Interline Power Flow Controller to Reduce Power System Losses Using GA and CS," 2017 CIGRE Auckland Asia-Oceania Regional Council (AORC) Technical Meeting, 11/9-13/9/2017, Auckland, New Zealand.

Papers Submitted (in 2017) to Journals

46. **Muwaffaq I. Alomoush**, "Improved optimal coordinated design of TCSC and PSS using grasshopper optimization algorithm," submitted for review and publication in Optimal Control Applications and Methods.
47. **Muwaffaq I. Alomoush**, "Using Grasshopper Optimization Algorithm to Improve Damping of a Power System Including IPFC, " submitted for review and publication in International Journal of Automation and Computing.
48. **Muwaffaq I. Alomoush** "Improved Robust Oscillations Damping in a Power System Equipped with an Interline Power Flow Controller Using Whale Optimization Algorithm," submitted for review and publication in Electric Power Components and Systems.
49. Khaled N. Nusair and **Muwaffaq I. Alomoush**, "Reactive Power Optimization Using Stochastic Fractal Search Algorithm," submitted for review and publication in the IEEE Transactions on Power Systems.
50. Khaled N. Nusair and **Muwaffaq I. Alomoush**, "Improved results of multi-objective optimal power flow using whale optimization approach," submitted for review and publication in IET Generation, Transmission & Distribution.
51. Khaled N. Nusair and **Muwaffaq I. Alomoush**, "Optimal Power Flow Using Multi-Verse Optimization Algorithm," submitted for review and publication in International Transactions on Electrical Energy Systems.
52. **Muwaffaq I. Alomoush** and Khaled N. Nusair "Optimal power flow using grasshopper optimization algorithm," submitted for review and publication in International Journal of Bio-Inspired Computation.
53. **Muwaffaq I. Alomoush**, "Whale Optimization Algorithm for Improved Robust Damped Oscillations in a Multi-Machine Power System," submitted for review and publication in Acta Polytechnica Hungarica.
54. **Muwaffaq I. Alomoush** "Grasshopper Optimization Algorithm for Robust Stabilization and Improved Oscillations Damping in a Multi-Machine Power System," submitted for review and publication in Swarm and Evolutionary Computation.

TEACHING ACTIVITIES

Courses

Undergraduate course:	Power Systems, Power System Analysis I, Power System Analysis II, Automatic Control Theory, Electric Circuit Analysis I, Electric Circuit Analysis II, Engineering Mathematics, Electronic Circuits, Engineering Drawing, Electrical Workshop, Electrical Machines I,
Graduate course:	Restructured Electrical Power Systems, Power System Operations and Control.

Labs

Automatic Control, Electric Circuit, Electronic Circuits, Electrical Workshop, Electric Machines, Power System Applications.

Graduation Projects

A large number of primary and secondary graduation projects, for undergraduate students, has been conducted under my supervision in different fields of electrical power engineering, including but not limited to, power system economics, power system security, power system sate estimation, electrical machines dynamics, power system dynamics, fuzzy logic, optimal controller design of electric machines and power systems, nuclear power plants, power system visualization, power system calculations, and learning power system software packages.

LANGUAGES

Arabic (Native), English (Excellent)

JOURNAL TECHNICAL REVIEW ACTIVITIES

1996–present: The *IEEE Transactions on Power Systems*.
1996–present: The *IEEE Transactions on Energy Conversion*.
2000–present: The *IEEE Power Engineering Letters*.
2002–present: The *Journal of Electric Power and Energy Systems*.
2008–present: The *European Transactions on Electrical Power*.
2008–present: The *International Journal of Engineering Education*.
2008–present: The *International Journal of Automation and Control*.
2008–present: The *International Journal of Modeling and Simulation*.
2009–present: The *IEEE Transactions on Power Delivery*.
2010–present: The *Journal of Dirasat, Jordan University*.
2010–present: The *IEEE Transactions on Evolutionary Computation*.
2015-present: The *Journal of Engineering Research.*
2015-present: The *Jordan Journal of Physics.*
2015-present: The *Jordan Journal of Electrical Engineering.*
2010-present: The *IET Generation, Transmission & Distribution*

CONFERENCE REFEREEING ACTIVITIES

Many national and international conferences.

SUPERVISION OF GRADUATE WORK

1. Co-Adviser: Eyad K. Maa'yteh, *Identification and Control of DC Motors Using Neural Network Based Appraoch*, Department of Computer Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2005.
2. Adviser: Sameer F. Mohammad, *An Improved Mechanism for Real-Time Reactive Power Pricing in a Competitive Electricity Market*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2010.
3. Adviser: Heba M. Aljamal, *Optimal Design of Interline Power Flow Controller to Damp Power System Oscillations Using Genetic Algorithm*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2010.

4. Adviser: Kahrman A. Al-Hamad, *Coordinated Tuning of TCSC and PSS in Multi-Machine Power Systems Using Particle Swarm Optimization*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2010.
5. Adviser: Ayman A. Al-Quraan, *Tuning of Unified Power Flow Power Flow Controller Using GA and PSO*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2011.
6. Adviser: Sami Zwatten, *Optimal Allocation of Distributed Generation in Distribution System Using Multiobjective Optimization*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2012.
7. Adviser: Habes A. Al Khawaldeh, *Tuning of Static Synchronous Compensator in a Power System for Oscillation Damping Using Fuzzy Logic*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2012.
8. Adviser: Issa Ibrahim Al-sleehat, *Optimal Location of UPFC in Jordanian Network Considering Nuclear Power Generation*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2012.
9. Adviser: Murad A. Al-Omary, *Optimal Design and Analysis of Hybrid Energy Systems (HES) for Some Study Cases in Jordan*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2012.
10. Adviser: Anas I. Maabreh, *Effect and Approximate Modeling of Interline Power Flow Controller (IPFC) In Power System Operation*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2013.
11. Co-Adviser: Ali I. Halabi, *Oscillation Damping Improvement of Multi-Machine Power System Including Thyristor-Controlled Phase Shifter (TVPS) By Simulated Annealing (SA*), Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2013.
12. Adviser: Zakaria Al-Qudah, *State Estimation of Power System Including Unified Power Flow Controller and Interline Power Flow*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2015.
13. Adviser: Ali Basil Othman, *Optimization of Interline Power Flow Controller to Minimize the Transmission Line Losses Using Genetic Algorithm*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2016.
14. Adviser: Zaid Basel Oweis, *Using Stochastic Fractal Search Algorithm to Solve Environmental-Economic Dispatch Including Wind Power*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2016.
15. Advisor: Khaled N. Nusair, *Reactive Power Optimization Including STATCOM Using Some Latest Evolutionary Algorithms*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2016.
16. Adviser: Abed-AL Rahman N. Hyasat, *Combined Economic and Emission Dispatch Using Lightning Search and Symbiotic Organisms Search Algorithms*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2017.
17. Adviser: Walaa S. Bani Saied, *Optimal Load Frequency Control of Multi-Area Power System Including Thyristor-Controlled Phase-Shifter Using Recent Global Optimization Algorithms*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2017.
18. Adviser: Muna Mazen Zayed, *Improved Solution of Multi-Objective Optimal Power Flow Using Some Latest Global Optimization Algorithms*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University,2018.
19. Adviser: Mohammed Adnan Al-Saadi, *Multi-Objective Optimal Power Flow Using Recent Intelligence Optimization Algorithms*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2018.

20. Adviser: Duha Talal Kanaan, *Using an Efficient Hybrid Algorithm for Solving Optimal Power Flow Problem with Unified Power Flow Controller*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2019.
21. Adviser: Mohammad N Shannag, *Economic Dispatch in a Stand-Alone Microgrid*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2019.
22. Adviser: Wala'a Ahmad Wahdan Al-Smadi, *Optimal Power Flow Including Renewable Energy Resources and Energy Storage*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2019.
23. Adviser: Nada Sulieman Hasan Abu-Alhaija'a, *Economic Dispatch Including Wind Generation Using Grasshopper Optimization Algorithm*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2019.
24. Adviser: Raya N. Almashour, *Impact of Wind Energy Resources on The Outcomes of The Optimal Power Flow*, Department of Power Engineering, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2019.

MEMBERSHIP OF UNIVERSITY COMMITTEES

- Member, Board of Trustees, Jordan University of Science and Technology (JUST), June 2018-Now.
- Member, Board of Trustees, American University of Madaba, March 2013-Decemcer 2016.
- Member, Scientific Research Council, Yarmouk University, September 2017-Now.
- Member, Energy Sector Committee, Scientific Research Support Fund, Ministry of Higher Education & Scientific Research, June 2017-Now.
- Member, 2016-2020 Strategic Plan Committee, Yarmouk University, 2015.
- Chairman, Scientific Research Committee, Hijjawi Faculty for Enineering Technology, Yarmouk Uinversity, Sept. 2015-August 2016, Sept. 2017-Now.
- Member, Department Graduate Studies Committee, Department of Electrical Power Engineering, Yarmouk University, Sept. 2015-Now.
- Member, Faculty Graduate Studies Committee, Hijjawi Faculty for Engineering Technology, Yarmouk University, Sept. 2015-Now.
- Chairman, Curriculum Committee, Al Albayt University, August 2012-August 2105.
- Chairman, the National Innovation and Research Conference for Jordanian Universities, Al Albayt University, 2013.
- Member of The Appointment and Promotion Committee, Al Albayt University, August 2012-August 2105.
- Chairman, Many Promotion Committees, Al Albayt University, August 2012- August 2105.
- Chairman and Member, Many Committees to establish and modify University Regulations, Al Albayt University, August 2012- August 2105.
- Member, Deans Council, Yarmouk University, for the academic years 2010/2011 and 2011/2012.
- Chairman, The Faculty Council, Hijjawi Faculty for Engineering Technology for the academic years 2010/2011 and 2011/2012.
- Member, The Faculty Council, Hijjawi Faculty for Engineering Technology for the academic years 2002/2003, 2008/2009, and 2009/2010.

- Member, The University Council for Graduate Studies for the academic years 2008/2009 and 2009/2010, representing the Hijjawi Faculty for Engineering Technology.
- Member, The Faculty Council, Hijjawi Faculty for Engineering Technology for the academic years 2002/2003, 2008/2009, and 2009/2010.
- Chairman, The Graduate Studies Committee, Hijjawi Faculty for Engineering Technology for the academic years 2008/2009 and 2009/2010.
- Chairman, The Curriculum Committee, Hijjawi Faculty for Engineering Technology for the academic years 2008/2009 and 2009/2010.
- Member of the Research Committee, Hijjawi Faculty for Engineering Technology for the academic year 2008/2009.
- Chairman, The Library Committee, Hijjawi Faculty for Engineering Technology for the academic years 2008/2009 and 2009/2010.
- Member, The ABET Accreditation Committee, Department of Power Engineering, Hijjawi Faculty for Engineering Technology
- Member of Faculty Website Developing Committee, Hijjawi Faculty for Engineering Technology for the academic year 2001/2002.
- Chairman and member of several promotions and sabbatical leave committees.
- Member of CIGRE National Committee representing the Yarmouk University, 2009, 2010.
- Chairman and member of many Graduation Project Exam Committees.
- Chairman and member of many Field Training Exam Committees.
- Member of many student transfer and equivalent courses committees, department of power Engineering.
- Member of the technical committee of the International Medical Informatics and Biomedical Engineering Symposium, Amman, Jordan, April, 2006.
- Member of the technical committee in charge of establishing the Technology Specialist programs at Hijjawi Faculty for Engineering Technology.
- Chairman, The Evaluation committee of Distinguished Student Awards, Hijjawi Faculty for Engineering Technology for the academic year 2007/2008.
- Member of the organizing committee of International Medical Informatics and Biomedical Engineering Industrial Show, Yarmouk University, 2009.
- Member of the Permanent Technical Committee for Electrical Equipments and Instruments (No. 42), Jordan Institution for Standards and Metrology (JISM), representing Yarmouk University, 2009-Now.
- Member of the Technical Evaluation Committee of the Candidate Incubator Innovative Projects, Jordan Innovative Center (JIC) at Al-Hassan Industrial Estate, Irbid, Jordan, representing Yarmouk University, 2007-Now.
- Chairman, The Organizing and Technical Committees of the Seminar of Applied Industries for Arab Universities, Yarmouk University, 2010.
- Chairman, The Organizing Committees of the Seminar of Renewable Energy for Arab Universities, Yarmouk University, 2010.

- Member of The Hisham Hijjawi Academic Distinction Award, Hijjawi Faculty for Engineering Technology, Yarmouk University, 2009.

MEMBERSHIP OF SCIENTIFIC AND PROFESSIONAL SOCIETIES

- Jordan Engineering Association.
- Engineering and Scientific Research Groups, Paris, France
- International Association of Engineers (IAENG), Hong Kong

COMPUTER SKILLS

MS-DOS, MS-Office, Adobe Acrobat, FORTRAN, Matlab, Simulink, LINDO, PowerWold Simulator, Many power Engineering Software packages.

PROFESSIONAL REFERENCES

- Prof. Sultan T. Abu-Orabi Aladwan
  Former Secretary General, Association of Arab Universities, Amman, Jordan
  Former President of Yarmouk University, Irbid, Jordan
  E-mail: abuorabi@yu.edu.jo , abuorabi@excite.com

- Prof. Abdullah Al-Musa
  Senator, The Jordanian Senate, Amman, Jordan
  Former President of Yarmouk University, Irbid, Jordan
  E-mails: Almusaa48@gmail.com , almusaa@ju.edu.jo

- Prof. Ahmad Fhakhri Al-Ajlouni
  Vice President of Yarmouk University, Irbid, Jordan
  Department of Communications Engineering
  Hijjawi Faculty for Engineering Technology
  Yamouk University, Irbid, Jordan
  E-mails: Al-Ajlouni@yu.edu.jo , alajloua@hotmail.com

STATEMENT OF TEACHING PHILOSOPHY

Muwaffaq I. Alomoush

ma@yu.edu.jo

"Students are candles to be lighted, not bottles to be filled"
[Greek writer-philosopher Plutarch]

I believe that the role of a teacher is that of a leader who shows the path, motivates, encourages and leads by example. An effective teacher ignites a student's desire to learn, a desire to improve on weaknesses, and a desire to succeed. A teacher should be totally involved with the class, dedicated to students and be willing to devote time and energy for them. Love for teaching evokes passion and dedication.

A good teacher should have sound fundamentals and command over the concepts as well as a broad knowledge beyond the realms of the particular course being taught. Thus, a teacher can provide useful inter-disciplinary examples which make learning very interesting and motivate the students. I set high standards for myself as well as for my students. In every course I teach I do my best to have thorough command of the subject matter. Therefore, I prepare for my lectures by reviewing the textbook material, reading my notes, browsing reference books and sometimes papers, until I feel comfortable that I understand it thoroughly. In addition, I try to integrate into my undergraduate and graduate classes the findings of my research. My enthusiasm comes naturally because I am a work-loving instructor.

A good teacher needs to personalize the needs and problems of the students as in the case of a few of the weaker or shy students who need additional help but hesitate to ask for it. Students tend to learn more effectively from an approachable teacher who sets up a comfortable atmosphere conducive to learning. Thus, the education goes beyond the classroom and students tend to visualize the teacher as a role model from whom they seek advice on topics ranging from fundamental concepts to future careers options, other personal problems and recommendations.

In the first lecture of every course after introducing myself to students and asking them to introduce themselves I ask them to share their thoughts on "what do think this course is about?", then I spend the rest of the lecture by exploring the title of the course and the text book. Then I elaborate on the importance of the course and its relevance to other future courses and career.

In my opinion, identifying the students by their full names and knowing some background information is very beneficial. Therefore, one of my philosophy's ingredients is that I learn students' names in the class and through my interactions with them during my office hours. I make a sincere effort to learn their names, even in classes with a large number of students. It is amazing how responsive students become when they think a teacher knows their names. I let them know they can approach me at any time to ask questions or seek advice.

I always teach my students to enjoy what they study in my course in order to get better grades. From my experience, having good sense of humor in certain situations is an added advantage. To make the learning process a pleasure, I motivate the class by asking "why we need to learn this part", "what is the relationship between this part and other parts?", "do you think there is other method to solve this problem?". At times, I ask the class some "what if"

questions in the end of solving an example. My class lectures always incorporate open questions, forcing students to share their thoughts. As a teacher, I recognize the importance of creating a learning environment where students feel safe to contribute, comfortable to criticize, and self-confident enough to ask questions.

I believe that technology is very useful and should be utilized effectively in teaching. I use handouts and visual aids whenever possible in my lectures. I have a collection of detailed transparencies, tutorials and lecture notes from good resources which I make available to students. In addition, I encourage the use of state-of-the art software packages related to the courses I teach.

Electrical engineering involves a significant amount of teamwork after graduation. Therefore, in advanced undergraduate courses and graduate courses, I strongly advocate reports, projects, papers and presentations involving student groups, which provide students with vital opportunities to effectively work as a team for the purpose of initiating group work.

Quiz, project, assignment, and exam are all feedback components, which are very important in teaching performance enhancement. In addition to faculty input, and discussions with peers, my students' responses are the best source for improving my teaching techniques which are evolving on a continuous basis. I highly value the role of feedback in teaching. After each exam I ask my students for any suggestions for improvements in the course for the rest of the semester, and to learn the level of satisfaction with the course and with the way I am teaching them.

As a teacher, I am not afraid to learn from students. Together with my students, I grow and learn in each class that I teach.

RESEARCH STATEMENT

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The main objectives of a power system are generating, transmitting and distributing electric power as economically and reliably as possible while maintaining quality of power, voltage magnitude, frequency and power flows within the acceptable limits. Electric power systems require continuous improvements in control, reliability and economic operation. Application of tools from the fields of optimization, decision-making and policy are essential for achieving these improvements and they have significant potential impact on power system economics. My research interests span the broad areas of both the traditional and restructured electrical power systems. These interests encompass restructuring models, economics, control, optimization, decision-making, congestion management, and security. My current research mainly focuses on modeling, control and applications of FACTS devices in restructured environment and for power system stability purposes. My future research will primarily focus on procuring and pricing of reactive power and applications of evolutionary computation techniques in power system operations and control.

Background and Motivation

For many decades, vertically integrated electric utilities monopolized the way they controlled, sold and distributed electricity to customers. These monopolies demonstrated that they could not provide services as efficiently as competitive firms. Therefore, the electric power industry planned to improve its efficiency by providing a more reliable energy at least cost to customers by steadily restructuring to a more market-based system in which competition would replace the role of regulation in setting the price of electric power. The main aim of restructuring is to let market forces drive the price of electric supply and reduce the net cost through increased competition. The restructuring of electric power industry has resulted in market-based approaches for unbundling a multitude of services provided by self-interested entities such as power generators, transmission providers, distribution companies and a host of others. As these entities move towards the restructured market-based operation, modified modeling and decision-making tools must be prepared to evaluate the impact of competition.

As an outcome of restructuring, importance of transmission system and alleviating its constraints have been intensively emphasized in order to provide grown bulk power transfer capability, to withstand a wider range of possible generation patterns and risks, and to facilitate a wider range of possible energy transactions. Consequently, electric utilities are looking for more flexible operation of transmission system and for new mechanisms by which transmission constraints can be mitigated to replace or help the traditional transmission constraint mitigation methods that usually result in expensive or undesired options.

One of the main issues faced the restructured systems was transmission congestion. Congestion could be caused for various reasons, such as transmission line outages, generator outages, changes in energy demand and uncoordinated transactions. Congestion may result in preventing new contracts, infeasibility in existing and new contracts, additional outages, monopoly of prices in some regions of power systems, and damages to system components. Congestion may be prevented to some extent and can be corrected by applying controls such

as FACTS devices, phase shifters, tap transformers, reactive power control, re-dispatch of generation and curtailment of loads.

Past Research

My past research was mainly focused on modeling the restructured competitive electrical power systems. Power system economics, transmission pricing and congestion management were key issues in my past research. I also applied different multi-objective decision-making tools from other fields to the restructured environment.

The system operator in a competitive energy market environment stands as a decision-making entity. The decision process usually involves conflicting objectives with different importance weights. Therefore, some of my past research presented some dispatch options and performance indices (measures) to compare these options. Using multi-criteria decision support methods, which have been applied successfully in many conflicting objective decision-making fields, the measures presented in my past research papers would enable the dispatch decision-making entity to compare and decide which dispatch among different dispatch scenarios is the optimal, based on agreed-upon preferences without resorting to a large number of comparisons.

Flexible AC transmission system (FACTS) devices have been newly developed. Their operations are realized using advanced quick-response power electronic components, which provide the required flexibility to operate power system. Their instant response to control inputs grants a high ability for power system stability enhancement in addition to control of steady-state operation. Recently, there has been an increased interest in studying the FACTS devices modeling, its effect on power system steady-state operations and oscillation damping.

As improving the reliability and economics of power systems are important research emphases, my research then has shifted a little towards the different applications of FACTS devices in restructured environment. This shift required exact and approximate modeling of these devices and integrating their models with the mathematical models of the competitive electricity market models. The FACTS devices are effective to alter power system parameters in order to increase power transfer capability, stabilize system, help energy market resolve congestion-caused problems, and maximize economic value of transmission system. Therefore, few of my paper in past research investigated modeling of FACTS devices and their impact on energy market dispatch outcomes, especially on resolving transmission congestion-related problems. I published a number of articles in the last few years describing modeling and a variety of applications of the FACTS devices.

Power system stability of electric power systems is a major research concern. Therefore, my past research was mainly focused on modeling, control and usage of FACTS for power system stability purposes. The resulted model of the power system including FACTS devices is nonlinear, which requires reliable optimization algorithms. One of these algorithms is the Bacterial Foraging (BF) optimization algorithm, which is a new promising evolutionary biologically inspired stochastic computation technique that gives optimal global solution. The algorithm imitates the foraging behavior of Escherichia coli (E. coli) bacteria that exist in human intestine, whose foraging habit is modeled as a distributed optimization process.

My past research applied the BF algorithm to design optimal controllers of a single-machine-infinite-bus (SMIB) system equipped with a FACTS device. The system was described by a set of nonlinear equations. The BF algorithm was used to tune the parameters of the FACTS device control signals in the nonlinear optimization process. The controllers are optimally tuned to

stabilize the system, increase system damping, and improve the steady-state response when the system is subjected to different disturbances. Simulations demonstrated that the optimal BF-based controllers would significantly stabilize the system and efficiently damp low frequency oscillations under severe disturbances. The results were compared to the results obtained using other optimization algorithms to show the effectiveness of using BF to attain a global optimal solution of the design problem.

Fractional calculus received extensive attention and research in the last decade. Accordingly, there was an increasing interest in fractional-order (FO) dynamic systems and controllers. My research applied FO controllers for FACTS to improve damping and stability of power systems, where I applied the fractional calculus to design optimal FO controllers of a nonlinear SMIB system equipped with FACTS devices. Evolutionary algorithms were used to tune the parameters of FACTS device controllers in the resulted nonlinear optimization process. Simulations demonstrated that the optimal FO controllers could significantly stabilize the system and efficiently damp low frequency oscillations under severe disturbances. Results also revealed that the optimal FO controllers obtained performed better to improve system dynamics than the traditionally used optimal integer-order (IO) controllers.

Current Research

In the old monopoly of the vertically integrated utility-structure, reactive power provision and voltage support were treated as obligations of the utilities and were bundled with other services while supplying electricity to the customers. However, in an open access, deregulated, competitive and market-based environment, it is a main responsibility of the system operator to maintain system security and reliability by a successful coordination of operations of electricity resources, transmission system and demand and any necessary ancillary services. Reactive power is a vital ancillary service in electricity markets to maintain acceptable margins for security and reliability of power system in order to enable trading in competitive electricity markets. Reactive power is a very important electric ingredient to maintain bus voltage limits and to balance the total demand with the least amount of power flowing in the transmission lines and minimum amount of total transmission loss. It is essential to maintain acceptable margins for security and reliability of power system in order to enable trading in the electricity market. Insufficient reactive power may result in voltage collapse of the system.

Even though reactive power has received an intensive research in the last two decade as a greater than before necessity for power system restructuring, it is still described as one of the least understood and recognized issues in the competitive electricity markets. There is strong insistence by regulators to price reactive power at its actual value and to deal with reactive power problems on a price basis in competitive-based electricity markets in order to ensure efficiency and transparency.

For the aforementioned reasons, my current research addresses procuring and improved mechanisms for reactive power pricing considering generator capability curve, reactive power resources and power factors. The research will show the coupled dependency of real power and reactive power and presents alternative formulations. The research will models the electricity market that concurrently considers both active and reactive powers by a new formulation that presents more accurate consideration of the generator capability curve. The market is modeled by a nonlinear optimization problem which considers, in addition to the traditional variable limits and constraints, new constraints that represent thermal limits of rotor and stator windings. The effect of capability curve limitations on the coupling between real and

reactive power locational marginal prices (LMPs) and energy cost is discussed and tested in different schemes of price bidding. The optimization problem is solved using one of the recent nonlinear optimization methods. Finally, this research discusses the importance of reactive power LMP in locating and pricing different reactive power resources.

Future Research

Optimal dispatch of generation mixture including combined heat power (CHP) units and renewable energy resources presently is a fundamental optimization issue for power system operators, especially with the worldwide major shift within the energy sectors caused by launching smart grid and MG schemes and technologies.

Solution of the CHPED problem earned a noteworthy investigation in a broad range of articles in the last few years. Therefore, my future research will deal with the multi-objective economic-emission dispatch problem of combined heat and power (CHP) generation in a large microgrid (MG). The MG comprises many types of fossil fuel generating units, wind power units, and solar power units. The objective functions involve unit operating costs, emission level, emission tax, and cost of power purchase from the main external grid. Interdependencies of heat and power outputs of CHP units and valve-point effects of thermal units impose non-convexities, nonlinearities and complications in the dispatch modeling and optimization. The intermittent stochastic nature of wind and solar power and considering transmission losses increase the complexity of the problem.

The research will use recent metaheuristic methods to solve the MG combined heat-power economic-emission dispatch problem (CHPED). Single and multi-objective solutions obtained for the MG CHPED will help MG operator (decision-maker) select the best optimal scenario among the achieved sets of solutions based on the pre-set preferences or priorities.

Conclusion

Economic and reliable operation of electric power systems are important societal goals for this century. The fields of decision-making, optimization, FACTS devices have crucial roles to play in achieving these goals. As there is considerable interest in these topics at the national and international levels, with interdisciplinary training in optimization, FACTS modeling, and Control along with previous research experience, I have a strong foundation for continued work in addressing the challenges faced by future electric power systems. In preparation for future successful research, I have exposed myself to interdisciplinary research fields.

I firmly believe the fundamental knowledge and the methodology I have gained from prior research experience will still be valid and useful in the future for the topics listed in the future research.

Overall, my research will consist of a good mix of futuristic and present-day research that is of practical significance and has immediate relevance and impact in industry. I intend to work closely with fellow researchers in both my field and other disciplines. I also plan to explore applications of my research topics that would be of interest to funding resources. To fulfill the future research goals, I intend to seek research support from funding sources.