Curriculum Vitae

Ali Elrayyah

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Summary:
Good knowledge and experience in modeling and control of power electronics systems, motor drives, distributed energy sources, demand side management and DC/AC microgrids. Good knowledge and experience in designing, reviewing and supervising installation of solar PV systems for grid-connected and islanded operation. Good Experience in designing and testing power electronics converters for power systems and motor drives. Experience in performing load flow analysis for power systems including microgrids and investigating stability and power quality of power systems. Capability of developing and implementing efficient algorithms for different aspects of power system control. Experience in automation, instrumentation, and wireless sensor networks. Ability to introduce creative and innovative solutions for proper operation and management of distributed energy sources.

Technical Skill Highlights:
Computer software and programming—Assembly, C/C++, Matlab, Python, Java, LabVIEW and OPAL-RT
Hardware design— schematic entry and PCB layout (Cadence Orcad), power electronics circuits testing and debugging.
Sensors and interfaces—testing and calibration of sensors (current, voltage, temperature/RH, CO2, flowmeters)
DSPs— (Microchip) DSPIC33F, (TI) TMS320F2812/TMS320F28335, (AD) ADSP-BF506F, and Arduino
Power systems analysis tool — DIgSILENT PowerFactory

Work Experience:

Neom, Saudi Arabia **July/2021-present**
Principle Engineer, Microgrid Modeling & Simulation

- Microgrid building blocks standardization for ease of integration and plug-&-play operation
- End-2-End design for microgrids (components identification, resources sizing, power network topology, control system, communication, protection, testing/commissioning procedure, and impact studies)
- Use-Case identification and techno-economic analysis for microgrid system in 100% RES-based power grids
- Leading the development distribution control and monitoring system (DCMS) and its interface with other control centers in NEOM grid
- Leading the strategy development for power systems analysis tools and their integration with system operation and planning
- Leading the task of defining smart meters specifications and requirements for NEOM distribution system to support smart grid management and control in 100% based power grids
- Leading the development of implementation roadmap, applications, and design guidelines for microgrid and DER management system in NEOM grid based on 100% renewable supply vision
- Reviewing designs of various regions in NEOM with regards to distributed energy resources integration and control
- Developing sizing and optimization tool to supply electrical and thermal energy to industrial facilities in NEOM which takes into consideration efficiency, performance ratio, and degradation of PV, batteries, thermal energy storage, battery thermal storage, concentrated solar power/heat, and geothermal power/heat
- Defining an optimized sizing and structure of district energy centers that combine district cooling, heating, and energy storage for resilient energy supply in 100% renewable based power grids
- Designing, modeling and simulation of microgrids in NEOM for residential, commercial, and industrial loads
- Defining and supervising the establishment of demand side management schemes for loads in NEOM
- Specifying, sizing, and siting sources and energy storage units at distribution voltage level based on optimized cost and

operation

- Participating in grid code development for sources in NEOM power network (reviewing draft in regard to distributed energy resources and their associated control systems)
- Defining and analyzing the interface between microgrid control system and transmission system
- Defining and analyzing advance grid support function to be provided by power electronic inverters/converters and the need to integrate elements such as STATCOM and synchronous condensers to support power quality and system stability.

Qatar Environment and Energy Research Institute (QEERI), Doha Qatar March/2014 - June/2021
Scientist

- Planning and systems development for smart grids applications and integrating renewable energy sources with utility grids. This work is to support Qatar national plan to increases the contribution of PV sources in the utility grid without affecting its performance and reliability. The conducted tasks include
    - Designing and supervising the establishment of 210kW microgrid with 100kW PV, 90 kW microturbines and 20 kW diesel generator. The microgrid can operate in grid connected as well as islanded modes. The microgrid can be operated using local and remote-control stations.
    - Designing and supervising the installation of a 30 kW microgrid system in an agricultural farm and developing a system controller for that microgrid. The system operates as grid connected microgrid where 30kW PV is integrated to support the added loads of 26 greenhouses and RO water desalination system. PLC based supervisory controller is programmed to manage PV inverters operation and curtail real power when needed for the purpose of avoiding undesirable voltage rise.
    - Developing and demonstrating a structure and control logic for multiple pumps sharing PV resources in a DC microgrid. The pumps and PV sources operate independently, but their control logics ensure sharing of available energy among various pumps based on their priority levels without explicit inter-controller's communication.
    - Developing and partially demonstrating a control system for residential loads supplied by PV power during off-grid operation without energy storage. The loads are classified based on their priority levels and with measurement of line voltage, interactive plugs and circuit breakers are turned ON/OFF to distribute available power among the appropriate set of loads.
    - Developing and demonstrating the establishment of hybrid DC/AC microgrid using conventional six-switch inverters. The system can help in increasing the utilization of PV inverters during nighttime to supply DC loads. The developed controller eliminates any coupling between AC and DC side effectively and smoothly.
    - Defining the negative impacts of increasing PV penetration in utility grids and proposing techniques to mitigate these challenges.
    - Developing a topology and a control system for three-phase resonant based smart microinverters to implement advanced grid functions
    - Developing low cost, effective and efficient systems for partial power processing for PV panels connected in serially in strings
    - Developing low cost and effective systems for differential power processing for parallel strings attached to the same inverter
    - Developing topologies for PV- battery hybrid inverters that operate in grid-connected as well as islanded mode of operation with seamless transition using an autonomous control scheme.
    - Developing a droop-based load management system for distributed demand response
    - Introducing simple yet effective analytical tools to determine the maximum PV installed capacity in any node within distribution feeders without violating the upper voltage limit
    - Developing a coordinated control logic between PV inverters and on-load tap changers (OLTCs) to eliminate any damaging impact on the latter by fluctuations in solar irradiance.
    - Developing effective power curtailing techniques for PV sources in distribution systems using optimally selected droop parameters to mitigate voltage rise and maintain fairness among these sources
    - Developing an optimized power curtailing strategy based on message exchange between central controllers at distribution systems and smart meters to mitigate voltage rise, maximize harvesting of solar energy and maintain

fairness among PV sources.
  - Developing a computer program to analyze utility wise distribution subsystems for voltage rise and flickering related to potential PV installations based on GIS and historical metrological data.
  - Estimating potential PV capacity and optimal inverter allocation on rooftops using 3D model of buildings through area determination and shading analysis.
  - Analyzing the impact of PV sources in power systems using real time simulation systems (OPAL-RT)
- Developing control system to remotely operate HVAC systems in residential buildings. Temperature/relative humidity sensors are distributed around the building and these measurements are exchanged wirelessly with the central controller to adjust the HVAC system operation. The user can interact with the system remotely using a mobile phone application developed in the project. Data about energy consumption and indoor temperature are uploaded in a Cloud data service.
- Designing and integrating instrumentation and control systems for heat harvesting from roads and buildings.
- Modeling and studying the applicability and economic feasibility of establishing purely PV power center-pivot irrigators. Detailed model for the water infiltration through different types of soil, evaporation and plant evapotranspiration, center pivot mechanical system and solar PV power supply.
- Integrating PV sources, HVAC, and refrigeration systems to achieve effective demand management for the purpose of peak load shaving in utility grids and smoother solar energy integration
- Establishing short term solar energy forecast based on the production of scattered PV modules for the purpose of power systems stabilization
- Delivering lectures to postgraduate students about renewable energy sources and microgrids

Enphase Energy, California USA **June/2013 - August/2013**
Internship

- Developing models for Enphase Energy microinverter integrated as large scale PV-farms. The model verification was done in lab setups of 5-51 inverters. The model is developed using MATAB/Simulink to allow the investigation of:
  - Transient over-voltage after phase to ground faults.
  - The effects of the inverter produced harmonics on the utility grid.
  - The effects of the inverter output capacitors on forming a resonance circuit with inductances of transformers and the coupling lines.
  - Specifying and testing protection strategies.
  - Checking stability and transient responses after major and minor disturbances in the utility or the PV- farm side.
  - Analyzing the negative sequence currents produced due to a drop of one/two of the PV-farm phases.
  - Performing load flow analysis for different power network configurations.
  - Studying the anti-islanding behaviors of many inverters in a PV-farm.

The University of Akron, Akron-Ohio **2010-Februray/2014**
Research Assistant

- Constructing 100 KW microgrid for research purpose which include
  - Selecting the sources, inverters, and loads.
  - Selecting the DSPs and developing the control algorithms.
  - Creating interface boards between the inverters and the DSPs.
  - Designing the microgrid setup.
  - Selecting the measurement equipment.
- Developing motor drive controllers for traction application
  - Developing a controller for 150 KW switched reluctance motors (SRM) for off-road vehicles applications. The controller was developed to operate the SRM smoothly with minimum torque ripple to achieve high speed operation without sacrificing efficiency.
- Developing an opto-sensor for truck braking systems for Bendix Corporation. In this project, the optical sensor is placed inside the chamber of the truck brakes to monitor the braking system operation and state of health. The tasks performed

in this project were:
- Selecting the sensors and controller.
- Developing the control algorithm.

King Fahd University of Petroleum and Minerals, Dhahran Saudi Arabia **2007-2010**
Research Assistant (2007-2009) and **Lecturer (2009-2010)**
- Developing and teaching Labs for undergraduate education
  - Linear control systems.
  - Digital control systems.
  - Embedded control systems.
- Participating in a project using distributed temperature and pressure sensors for oil-well applications. In this project the optical fiber deployed previously to monitor the well digging process was utilized to analyze the temperature and the pressure along the well. (for Saudi Aramco).
- Developing a controller for thermal solar energy system. The control algorithm was developed to ensure the stability of the system despite the long delay imposed by the mass transfer process.

National Telecommunication Corporation, Khartoum Sudan **2004-2007**
Wireless Spectrum Monitoring Engineer
- Developing software tools to manage and license the use and the wireless spectrum.
- Performing spectrum monitoring and scanning.

International University of Africa, Khartoum Sudan **2004-2007**
Teaching Assistant
- Establishing, developing manuals and teaching Labs
  - Digital Systems I & II
  - Electronic Circuit I & II

Samples of performed Research Work
- Development of efficient and robust single phase PLL for utility interactive inverters. The PLL is developed to be robust against voltage harmonics and voltage sag/sell.
- Development of an efficient algorithm to estimate the harmonics in the utility grid and participate in harmonics compensation. The algorithm is developed to be efficient, fast, and accurate.
- Controllers development for microgrid-connected PV sources. This research considers islanded microgrids with high PV penetration levels. Control algorithm is developed to ensure microgrid stability after major load changes.
- Introduction of load flow analysis tool for islanded microgrids. This tool is developed to help power system designers and operators assess the system operation under islanded microgrid configuration where no communication exists among sources. This tool can be used for tuning local controllers of sources to optimize microgrids operation.
- Development of control algorithms to ensure smooth transitions of inverters from grid connected to islanded modes of operation. Through local measurements, the algorithm allows the source in microgrids to switch between current and voltage control during any transition in their modes of operation.
- Development of micro-electro-mechanical sensor (MEMS) for monitoring batteries state of charge and state of health.
- Development of smart thermostat based on distributed sensor networks for combined temperature/relative humidity to enhance comfort and attain energy saving in residential buildings

Education
PhD (2013), Electrical Engineering (GPA 4.0/4.0**)**
The University of Akron—Akron, OH
MSc (2009), Systems Engineering (Control and Instrumentation) (GPA 4.0/4.0**)**
King Fahd University of Petroleum and Minerals, Saudi Arabia

BSc (2003), Electrical Engineering (GPA 7.85/10**)**
University of Khartoum, Sudan

Awards

- Best performing member of energy management department at Qatar Environmental and Energy Research institute, 2018.
- Outstanding graduate researcher in electrical engineering department (The University of Akron, 2013)
- Best graduate student in systems engineering department (King Fahd University of Petroleum and Minerals, 2009)
- Best final year project for undergraduate student in electrical engineering department (University of Khartoum 2003)

PhD Dissertation:

The title of the dissertation is "Modeling and control of microgrid-connected PV sources (MCPV)". The research comprises of developing 100 KW microgrid to test and evaluate various microgrid control strategies. The microgrid is fed mainly be PV sources whose controllers are designed to satisfy two objectives. The first objective is to track maximum power points (MPPs) of PV sources during steady state operation. Since the microgrid may operate in the islanded mode, the PV control needs to have the functionality of regulating voltage and frequency and to ensure stability of the microgrid. Therefore, the second objective is to ensure smooth and stable transient by applying the well-known droop control after any major disturbance in the microgrid. The MPP controller and the droop controller are combined together in the MCPV control system to operate autonomously, i. e. without inter-sources communication. By modeling the entire microgrid, the controllers could be tuned, and the stability could be investigated. Another part of the dissertation is to develop perform load flow analysis (LFA) tool for islanded microgrids which is combined with an algorithm to optimize sources utilization and power quality. The proposed controllers were validated by simulation and experimental studies.

References:

1. Dr. **Yilmaz Sozer** Assistant Professor, The University of Akron, OH-USA Electrical and Computer Engineering. Email: ys@uakron.edu. Phone: +15184954391
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4. Dr. **Antonio Sanfilippo**, Chief Scientist, Qatar Environment and Energy Research Institute, Doha Qatar. Email: asanfilippo@hbku.edu.qa. Phone: +974 445447157
5. Dr. **Grain Philip Adam** Lead Engineer, Component Modeling & Digital Twin, ENOWA, NEOM, Saudi Arabia. Email: grain.adam@neom.com, phone +966502134676
6. Dr. **Nand K. Singh**, Senior Manager- HV Grid Planning and Integration, ENOWA, NEOM, Saudi Arabia. Email: nand.singh@neom.com, Phone: +966553083709
7. Dr. **Islam Safak Bayram** Lecturer B, Electronic and Electrical Engineering, University of Strathclyde: Glasgow, GB. Email: safak.bayram@strath.ac.uk,

Publications

(Conferences)

1. **A. Elrayyah**, Y. Sozer, I. Husain and M. Elbuluk, "Power flow control in a microinverter based microgrid", Applied Power Electronics Conference and Exposition (APEC), 2012 Twenty-Seventh Annual IEEE, pp. 1933 – 1939, Feb 2012.
2. **A. Elrayyah**, Y. Sozer and M. Elbuluk, "Simplified modeling procedure for inverter-based islanded microgrid" EnergyTech IEEE, Cleveland, OH, May 2012.
3. **A. Elrayyah**, A. Safayet, Y. Sozer, I. Husain and M. Elbuluk "Novel methods for grid voltage harmonics elimination and estimation" Energy Conversion Congress and Exposition (ECCE), 2012 IEEE, pp. 4683 – 4689, Sep. 2012.
4. **A. Elrayyah**, Y. Sozer and M. Elbuluk "Control of microgrid-connected PV sources" Industry Application Society (IAS) 2012, pp. 1–8, Oct. 2012.
5. **A. Elrayyah**, K. Namburi, Y. Sozer, and I. Husain, "A novel dithering algorithm to reduce the electro-magnetic interference (EMI) in single phase DC/AC inverters", Energy Conversion Congress and Exposition (ECCE), IEEE, pp. 652 – 659, Sep. 2012.
6. **A. Elrayyah**, S. Elferik, T. Othman and M. Rashid Khan, "Distributed temperature control for solar energy system: an LMI approach", 9th International Multi-Conference on Systems, Signals and Devices (SSD), 2012, pp. 1-6, March 2012.
7. **A. Elrayyah**, Y. Sozer and M. Elbuluk "A novel load flow analysis for particle-swarm optimized microgrid power sharing" Applied Power Electronics Conference and Exposition (APEC), 2012 Twenty-Seventh Annual IEEE, pp. 297–302, March 2013.
8. **A. Elrayyah**, Y. Sozer and M. Elbuluk, "A robust and efficient PLL algorithm for single-phase grid-connected renewable energy sources" Applied Power Electronics Conference and Exposition (APEC), 2012 Twenty-Seventh Annual IEEE, pp. 2940 – 2946, March 2013.
9. **A. Elrayyah**, and Y. Sozer, "Improving the operation of microgrid interfaced inverter using L-type filter", Applied Power Electronics Conference and Exposition (APEC), 2012 Twenty-Seventh Annual IEEE, pp. 2947–2952, March 2013.
10. **A. Elrayyah** and Y. Sozer, "Construction of nonlinear droop relations to optimize islanded microgrids operation", Energy Conversion Congress and Exposition (ECCE), 2012 IEEE, pp. 1663-1668, Sep. 2013.
11. T. Husain, **A. Elrayyah**, Y. Sozer and I. Husain, "An efficient universal controller for switched-reluctance machines", Applied Power Electronics Conference and Exposition (APEC), Twenty-Seventh Annual IEEE, pp. 1530–1536, March 2013.
12. T. Husain, **A. Elrayyah**, Y. Sozer and I. Husain, "DQ control of switched reluctance machines", Applied Power Electronics Conference and Exposition (APEC), 2012 Twenty-Seventh Annual IEEE, pp. 1537–1544, March 2013.
13. A. S. Mahmoud, **A. Al-Rayyah** and T. Sheltami, "Adaptive power allocation to support absolute proportional rates constraint for scalable ofdm systems", Vehicular Technology Conference (VTC), pp. 1 - 4, May 2010.
14. Md. Arafat, **A. Elrayyah** and Y. Sozer, "Hybrid droop and current control for seamless transition mode of microgrids", EnergyTech IEEE, Cleveland, OH, 2013.
15. S. Anwar, **A. Elrayyah** and Y. Sozer, "Harmonics elimination and distribution using decentralized control for microgrid applications", EnergyTech IEEE, Cleveland, OH, 2013.
16. Md. Arafat, **A. Elrayyah** and Y. Sozer, "An effective smooth transition control strategy using droop-based synchronization for parallel inverters", Energy Conversion Congress and Exposition (ECCE), 2012 IEEE, pp. 2318-2324, Sep. 2013.
17. S. Anwar, **A. Elrayyah** and Y. Sozer, "Efficient single phase harmonics elimination method for microgrids operating in grid connected or standalone mode", Energy Conversion Congress and Exposition (ECCE), 2012 IEEE, pp. 4671-4677, Sep. 2013.

18. T. Husain, **A. Elrayyah**, Y. Sozer and I. Husain, "Adaptive flux weakening control of switched reluctance machines in rotating reference frame", Energy Conversion Congress and Exposition (ECCE), 2012 IEEE, pp. 912-919, Sep. 2013.
19. A. Safayet, I. Husain, **A. Elrayyah**, and Y. Sozer, "Grid harmonics and voltage unbalance effect elimination for three-phase PLL grid synchronization algorithm", Energy Conversion Congress and Exposition (ECCE), 2012 IEEE, pp. 3299-3304, Sep. 2013.
20. M. O. Badawy, **A. Elrayyah**, F. Cingoz, and Y. Sozer, "Non-isolated individual MPP trackers for series PV strings through partial current processing technique," Applied Power Electronics Conference and Exposition (APEC), 2014 Twenty-Ninth Annual IEEE, pp. 3034-3041, March 2014.
21. S. Anwar, **A. Elrayyah**, and Y. Sozer, "Efficient single phase power factor improvement strategy for microgrid operation", Applied Power Electronics Conference and Exposition (APEC), 2014 Twenty-Ninth Annual IEEE, vol., no., pp. 972-977, March 2014.
22. F. Cingoz, **A. Elrayyah**, M. O. Badawy, and Y. Sozer, "Reliability and cost analysis of solar photovoltaic and fuel cell based microgrids", Applied Power Electronics Conference and Exposition (APEC), 2014 Twenty-Ninth Annual IEEE, vol., no., pp.3166-3173, 16-20 March 2014.
23. **A. Elrayyah**, and Y. Sozer, "Effective dithering technique for EMI reduction in three phase DC/AC inverters", Applied Power Electronics Conference and Exposition (APEC), 2014 Twenty-Ninth Annual IEEE, vol., no., pp.2401-2406, 16-20 March 2014.
24. F. Cingoz, **A. Elrayyah** and Y. Sozer, "Plug and play nonlinear droop construction scheme to optimize microgrid operations", IEEE Energy Conversion Congress and Exposition (ECCE), 2014.
25. S. Anwar, A. Elrayyah and Y. Sozer, "Harmonics Compensation and Power Factor Improvement using LED Driver", IEEE Energy Conversion Congress and Exposition (ECCE), 2014.
26. A. Saha, Y. Sozer and **A. Elrayyah**, "Capacitor voltage balancing of a five-level diode-clamped converter using minimum loss SVPWM algorithm for wide range modulation indices," IEEE Energy Conversion Congress and Exposition (ECCE), Pittsburgh, PA, pp. 227-233, 2014.
27. Md. Arafat, **A. Elrayyah** and Y. Sozer, "An effective smooth transition control strategy using droop-based synchronization for parallel inverters," IEEE Energy Conversion Congress and Exposition (ECCE), 2014.
28. **A. Elrayyah, "**Droop based demand response for power systems management," Smart Grid and Renewable Energy, pp.1-5, 2015.
29. A. Bousselham, and **A. Elrayyah**, "Autonomous control of combined PV and battery sources for reliable power systems," PCIM Europe, pp.1-7, 19-20, 2015.
30. **A. Elrayyah**, and Y. Sozer, "Low complexity structure and control for microinverters with reactive power support capability," IEEE Energy Conv. Cong. Expo., pp.4557-4562, 2015.
31. F. Cingoz, **A. Elrayyah**, and Y. Sozer, "Optimized settings of droop parameters using stochastic load modeling for effective DC microgrids operation," IEEE Energy Conversion Congress and Exposition (ECCE), pp.512-518, 2015.
32. A. Ibrahem, **A. Elrayyah**, Y. Sozer, and A. De Abreu, "DC railway system emulator for stray current and touch voltage prediction," IEEE Energy Conversion Congress and Exposition (ECCE), pp.1320-1326, 2015.
33. **A. Elrayyah**, M. O. Badawey and Y. Sozer, "Feeding partial power into line capacitors for low cost and efficient mppt of photovoltaic strings," Applied Power Electronics Conference and Exposition (APEC), 2016.
34. **A. Elrayyah**, "Low cost and high efficiency topology for flexible integration of Multi-PV and batteries in resonant-based converters," Applied Power Electronics Conference and Exposition (APEC), 2016.
35. M. A. Elmutalab, **A. Elrayyah**, T. Husain and Y. Sozer, "Extending the speed range of a switched reluctance motor using a fast-demagnetizing technique," IEEE Energy Conversion Congress and Exposition (ECCE), Milwaukee, WI, 2016, pp. 1-7, 2016.
36. **A. Elrayyah**, A. Ibrahem and Y. Sozer, "Effective control approach for multi-PVs based resonant converter through cross-switched structure," IEEE Energy Conversion Congress and Exposition (ECCE), Milwaukee, WI, pp. 1-7, 2016.

37. A. Saha, **A. Elrayyah** and Y. Sozer, "A simple double mapping based SVPWM method for balancing dc-link capacitor voltages of five-level diode-clamped converters," IEEE Applied Power Electronics Conference and Exposition (APEC), Long Beach, CA, pp. 2806-2812, 2016.
38. A. Saha, **A. Elrayyah** and Y. Sozer, "A novel three-phase multilevel diode-clamped inverter topology with reduced device count," IEEE Energy Conversion Congress and Exposition (ECCE), Milwaukee, WI, 2016, pp. 1-6, 2016.
39. M. Z. C. Wanik, A. Bousselham and **A. Elrayyah**, "Real-time simulation modeling for PV-battery based microgrid system," IEEE International Conference on Power System Technology (POWERCON), Wollongong, NSW, pp. 1-6, 2016.
40. A. Bousselham and **A. Elrayyah**, "Control and efficient operation of low cost multi PV-based LLC resonant microinverters," IEEE 43rd Photovoltaic Specialists Conference (PVSC), Portland, OR, 2016, pp. 3457-3462, 2016.
41. M. Elamin, Y. Yasa, **A. Elrayyah** and Y. Sozer, "Performance improvement of the delta-connected SRM driven by a standard three phase inverter," 2017 IEEE International Electric Machines and Drives Conference (IEMDC), Miami, FL, pp. 1-7, 2017.
42. F. Cingoz, **A. Elrayyah**, Y. Sozer and J. A. DeAbreu-Garcia, "An effective DC microgrid operation using a line impedance regulator," IEEE Energy Conversion Congress and Exposition (ECCE), Cincinnati, OH, pp. 52-57, 2017.
43. F. Mumtaz, I. S. Bayram, and **A. Elrayyah**, "Importance of energy storage system in the smart grid." Communication, Control and Security Challenges for the Smart Grid. IEEE, pp. 247-283, 2017.
44. A. Saha, **A. Elrayyah**, M. Sital-Dahone and Y. Sozer, "Fault-tolerant operation of multilevel diode-clamped converters for a device open-circuit fault," IEEE Applied Power Electronics Conference and Exposition (APEC), Tampa, FL, pp. 1873-1879, 2017.
45. O. Kilic, **A. Elrayyah**, and Y. Sozer, "Torque ripple minimization in SRMs at medium and high speeds using a multi-stator windings with a novel power converter". Applied Power Electronics Conference and Exposition (APEC), 2018.
46. S. M. Chowdhury, M. E. Haque, **A. Elrayyah**, Y. Sozer and J. A. De Abreu-Garcia, "An integrated control strategy for state of charge balancing with output voltage control of a series connected battery management system," 2018 IEEE Energy Conversion Congress and Exposition (ECCE), Portland, OR, 2 pp. 6668-6673, 2018.
47. H. Abdelgabir, A. R. Boynuegri, **A. Elrayyah** and Y. Sozer, "A complete small signal modelling and adaptive stability analysis of nonlinear droop-controlled microgrids," IEEE Applied Power Electronics Conference and Exposition (APEC), San Antonio, TX, pp. 3333-3339, 2018.
48. H. Abdelgabir, **A. Elrayyah** and Y. Sozer, "A center of mass determination for the optimum placement and deployment of the renewable energy sources for micogrids," IEEE Energy Conversion Congress and Exposition (ECCE), Portland, OR, pp. 5873-5878, 2018.
49. A. Ali, J. Lange, **A. Elrayyah**, Y. Sozer, J. A. De Abreu-Garcia and A. Mpanda, "A hybrid flyback LED driver with utility grid and renewable energy interface," IEEE Applied Power Electronics Conference and Exposition (APEC), San Antonio, TX, pp. 3377-3384, 2018.
50. A. A. Jabbar, **A. Elrayyah**, M. Z. C. Wanik, A. P. Sanfilippo and N. K. Singh, "Development of hybrid ac/dc laboratory-scale smart microgrid testbed with control & monitoring system implementation in LABView," IEEE PES GTD Grand International Conference and Exposition Asia (GTD Asia), Bangkok, Thailand, pp. 889-894, 2019.
51. **A. Elrayyah**, "Control algorithms to establish hybrid ac/dc distribution systems using conventional three phase inverters," IEEE Energy Conversion Congress and Exposition (ECCE), Baltimore, MD, USA, pp. 6246-6253, 2019.
52. **A. Elrayyah** and S. Bayhan, "Multi-channel-based power system for reliable operation and load sharing," 2019 IEEE 13th International Conference on Compatibility, Power Electronics and Power Engineering (CPE-POWERENG), Sonderborg, Denmark, 2019, pp. 1-6, 2019.

53. **A. Elrayyah, "**Effective droop control to mitigate PV-related voltage rise in LV systems through reactive power balancing and fair power curtailment", 12th International Exergy, Energy, and Environment Symposium, Doha, Qatar, 2020.
54. **A. Elrayyah** and N. K. Singh, "Autonomous control strategy for reliable OLTC operation under PV power fluctuation with effective voltage regulation," IEEE Energy Conversion Congress and Exposition (ECCE), Detroit, MI, USA, pp. 2766-2772, 2020.
55. **A. Elrayyah**, "LLC converters power density enhancement through optimized current shaping using multi-resonant branches," IEEE Energy Conversion Congress and Exposition (ECCE), Detroit, MI, USA, pp. 370-376, 2020.
56. N. K. Singh, **A. Elrayyah** and M. Z. C. Wanik, "Analysis of voltage rise and optimal PV curtailment strategy for its mitigation," IEEE PES Innovative Smart Grid Technologies Europe (ISGT-Europe), The Hague, Netherlands, pp. 610-614, 2020.
57. S. Bayhan and **A. Elrayyah**, "Power quality examination of measured data at point of customer connection in Qatar," IEEE 29th International Symposium on Industrial Electronics (ISIE), Delft, Netherlands, pp. 959-964, 2020.
58. **A. Elrayyah**, "Analysis and Implementation of Current Controller with Reduced Delay for LCL-based Inverters." *2021 IEEE Applied Power Electronics Conference and Exposition (APEC)*. IEEE, 2021.
59. A. Abotaleb, D. Almasri, **A. Elrayyah,** M. Al-Kuwari, and A. Amhamed, "Sustainable Energy Harvesting System for Roads in Desert Climate," Sustainable Energy-Water-Environment Nexus in Deserts Springer, Cham. pp. 369-379, 2022.
60. M. Z. Wanik, **A. Elrayyah**, A. AbdulJabbar, "Techno-economic Analysis of PV-Battery-Diesel Generation System for Qatari Remote Desert Farm Application. InSustainable Energy-Water-Environment Nexus in Deserts 2022 (pp. 423-431). Springer, Cham.

(Journals)

1. Magdi S. Mahmoud and **Ali Y. Al-Rayyah**, "Efficient Parameterization to Stability and Feedback Synthesis of Linear Time Delay Systems", IET Proceeding Control Theory and Appl., vol. 3, no. 8, pp. 1107-1118, 2009.
2. **Ali Y. Al-Rayyah** and Magdi S. Mahmoud, "Decentralized Reliable Control of Interconnected Time-Delay Systems against Sensor Failure", Journal of Optimization Theory and Applications, vol. 147, no. 2, pp. 318-336, 2010.
3. Magdi S. Mahmoud and **Ali Y. Al-Rayyah**, "Adaptive Control of Systems with Mismatched Nonlinearities and Time-Varying Delays using State-Measurements", IET Proceeding Control Theory and Application, vol. 4 , pp. 27-36, Jan 2010.
4. Magdi S. Mahmoud and **Ali Y. Al-Rayyah**, "Improved Robust Stability Criteria for Neural Networks with Fast Time-Varying Delays", Journal of Systems and control engineering, vol. 224, no. 5, pp. 521-528, 2010.
5. **A. Elrayyah** and Magdi S. Mahmoud, "Quantized Feedback Stabilization of Interconnected Continuous time-delay Systems", IMA journal of Mathematical Control, 28, 1-17, 2011.
6. Magdi S. Mahmoud and **Ali Y. Al-Rayyah**, "Stabilizing Nonlinear Systems with Time-Varying Delay by New Parametrized Method", Internation Journal of systems, control and communication, vol. 3, pp. 104-119, Jan 2011.
7. M.S. Mahmoud, **A. Y. Al-Rayyah**, and Y. Xia, "Quantized feedback stabilization of interconnected discrete-delay systems," Control Theory & Applications, IET, vol.5, no.6, pp.795-802, April 2011.
8. **A. Elrayyah**, K. Namburi, Y. Sozer and I. Husain, "An Effective Dithering Method for Electro-Magnetic Interference (EMI) Reduction in Single Phase DC/AC Inverters", IEEE Transactions on Power Electronics., vol. 29, no. 6, pp. 2798,2806, 2014.
9. **A. Elrayyah**, Y. Sozer and M. Elbuluk, "A Robust and Efficient PLL Algorithm for Single-Phase Grid-Connected Renewable Energy Sources", Power Electronics, IET, vol.7, no.5, pp.1064-1072, 2014.
10. **A. Elrayyah**, A. Safayet, Y. Sozer, I. Husain and M. Elbuluk, "Efficient Harmonic and Phase Estimator for Single Phase Grid-Connected Renewable Energy Systems", IEEE Transactions on Industry Applications, vol.

50, no. 1, pp. 620-630, 2014.

11. **A. Elrayyah**, Y. Sozer and M. Elbuluk, "A Novel Load Flow Analysis for Stable and Optimized Microgrid Operation", IEEE Transactions on Power Delivery, vol. 29, no. 4, pp. 1709-1717, 2014
12. **A. Elrayyah**, Y. Sozer, and M. Elbuluk, "Modeling and Control Design of Microgrid Connected PV-Based Sources", IEEE Journal of Emerging and Selected Topics in Power Electronics, 2014.
13. **A. Elrayyah**, Y. Sozer and M. Elbuluk, "Microgrid-Connected PV-Based Sources: A Novel Autonomous Control Method for Maintaining Maximum Power," IEEE Industry Applications Magazine, vol. 21, no. 2, pp. 19-29, 2015.
14. **A. Elrayyah,** F. Cingoz, and Y. Sozer, "Construction of Nonlinear Droop Relations to Optimize Islanded Microgrid Operations", IEEE Transactions on Industry Applications, vol. 51, no. 4, pp. 3404-3413, 2015.
15. S. Anwar, **A. Elrayyah,** and Y. Sozer, "Efficient Single Phase Harmonics Elimination Method for Microgrids Operation", IEEE Transactions on Industry Applications, vol.51, no.4, pp. 3394-3403, 2015.
16. Md. Arafat, **A. Elrayyah,** and Y. Sozer, "An Effective Smooth Transition Control Strategy using Droop Based Synchronization for Parallel Inverters", IEEE Transactions on Industry Applications, vol. 51, no.3, pp. 2443-2454, 2015.
17. F. Cingoz, **A. Elrayyah** and Y. Sozer, "Optimized Droop Control Parameters for Effective Load Sharing and Voltage Regulation in DC Microgrids", Electric Power Components and Systems, vol. 43, no. 8-10, pp. 879-889, 2015.
18. T. Husain, **A. Elrayyah**, Y. Sozer and I. Husain, "Flux-Weakening Control of Switched Reluctance Machines in Rotating Reference Frame," IEEE Transactions on Industry Applications, vol. 52, no. 1, pp. 267-277, 2016.
19. F. Cingoz, **A. Elrayyah** and Y. Sozer, "Optimized Resource Management for PV–Fuel-Cell-Based Microgrids Using Load Characterizations," IEEE Transactions on Industry Applications, vol. 52, no. 2, pp. 1723-1735, 2016.
20. **A. Elrayyah**, M. Z. C. Wanik and A. Bousselham, "Simplified Approach to Analyze Voltage Rise in LV Systems with PV Installations Using Equivalent Power Systems Diagrams," IEEE Transactions on Power Delivery, vol. 32, no. 4, pp. 2140-2149, 2017.
21. F. Cingoz, **A. Elrayyah** and Y. Sozer, "Plug-and-Play Nonlinear Droop Construction Scheme to Optimize Islanded Microgrid Operations," IEEE Transactions on Power Electronics, vol. 32, no. 4, pp. 2743 - 2756, 2017.
22. A. Ibrahem, **A. Elrayyah**, Y. Sozer and J. A. D. Abreu-Garcia, "DC Railway System Emulator for Stray Current and Touch Voltage Prediction," IEEE Transactions on Industry Applications, vol. 53, no. 1, pp. 439-446, Jan.-Feb. 2017.
23. F. Cingoz, **A. Elrayyah** and Y. Sozer, "Optimized Settings of Droop Parameters Using Stochastic Load Modeling for Effective DC Microgrids Operation," IEEE Transactions on Industry Applications, vol. 53, no. 2, pp. 1358-1371, 2017.
24. **A. Elrayyah**, F. Cingoz, and Y. Sozer, "Smart Loads Management Using Droop-Based Control in Integrated Microgrid Systems," IEEE Journal of Emerging and Selected Topics in Power Electronics , vol.5, no. 3, pp. 1142 – 1153, 2017.
25. M. Abd Elmutalab, **A. Elrayyah**, T. Husain and Y. Sozer, "Extending the Speed Range of a Switched Reluctance Motor Using a Fast Demagnetizing Technique," IEEE Transactions on Industry Applications, vol. 54, no. 4, pp. 3294-3304, 2018.
26. T. Husain, **A. Elrayyah**, Y. Sozer and I. Husain, "Unified control for switched reluctance motors for wide speed operation," IEEE Transactions on Industrial Electronics, vol. 66, no. 5, pp. 3401-3411, 2019.
27. **A. Elrayyah**, and S. Bayhan, "Multi-channel-based microgrid for reliable operation and load sharing," Energies 12.11, 2070, 2019
28. **A. Elrayyah**, "Control algorithms to establish hybrid ac/dc distribution systems using conventional six-switch inverters," IEEE Journal of Emerging and Selected Topics in Power Electronics, vol. 9, no. 4, pp. 4470-4481, 2020.
29. M. O. Badawy, M. Sharma, C. Hernandez, **A. Elrayyah**, S. Guerra, J. C'oe, "Model predictive control for multi-port modular multilevel converters in electric vehicles enabling HESDs. IEEE Transactions on Energy Conversion, vol. 37, no. 1, pp. 10-23, 2021.
30. S. Harasis, H. Abdelgabir, Y. Sozer, M. Kisacikoglu, **A. Elrayyah**, "A Center of Mass Determination for Optimum Placement of Renewable Energy Sources in Microgrids". IEEE Transactions on Industry Applications, vol. 57, no. 5, pp.

5274-84, 2021.

31. H. Abdelgabir, M.N. Shaheed, **A. Elrayyah**, and Y. Sozer, "Complete Small-Signal Modelling and Adaptive Stability Analysis of Nonlinear Droop-Controlled Microgrids." IEEE Transactions on Industry Applications, vol. 58, no. 6, pp.7620-7633.
32. S. Bayhan and **A. Elrayyah**. "Model Predictive Control in Photovoltaic Application: A Case Study for Qatar Agriculture." In *Sustainable Energy-Water-Environment Nexus in Deserts*, pp. 333-342. Springer, Cham, 2022.

(Patent)

1. A. Mahmoud, **A. Alrayyah**, "OFDMA power allocation method", US Patent, US 8,213,376, issued July 2012.
2. Y. Sozer, T. Haussien and **A. Elrayyah**, "D-Q control system and method for controlling a switched reluctance motor", US Patent Application, US 14,596,462, 2015.
3. **A. Elrayyah** and A. Bousselham, "Hybrid partial power processing system," US Patent, US 10,147,825, 2018.
4. **A. Elrayyah**, "Methods and systems of power production." U.S. Patent Application No. 17/196,372, 2021.