#### *Prof. MERVAT ABD EL-SATTAR BADR*

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 *National Research Centre*, *(NRC)*

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***AFFILIATION***

##### Emeritus Professor, Mechanical Engineering Department,National Research Centre

***QUALIFICATIONS***

Ph.D. degree, Faculty of Engineering, Cairo University, Egypt, 1993

 "***Techno-Economic Analysis of A Hybrid Renewable Energy System Using Simulation***"

###### M. Sc. degree, Faculty of Engineering, Cairo University, Egypt, 1986

"***A Computer Simulation Model to Analyze the Performance of A Wind Turbine System***”

B.Sc. degree in Mechanical Design & Production, Faculty of Engineering, Cairo University, Egypt, 1973.

# *ACADEMIC EXPERIENCE*

**Research Assistant ,** Mech. Eng. Department, N.R.C. 1974-1986

**Assistant Researcher,** Mech. Eng. Department, N.R.C. 1986-1993

**Researcher** **,** Mech. Eng. Department, N.R.C 1993-2000

**Associate Professor** **,** Mech. Eng. Department, N.R.C 2001- 2010

**Professor** , Mech. Eng. Department, N.R.C 2010- 2011

**Emerita Professor** , Mech. Eng. Department, N.R.C 2011-

***Training:***

1. A Course on Thermal Application of Solar Energy. Catania, Italy. June, 1985.

3. Progress in International Cooperation on Renewable Energy. Rome, Italy. May, 1986.

***SPECIALIZATION***

**Power and Energy Engineering:** Research & Projects 1980- till now

**Industrial Engineering:** Teaching (Part time) 1996- till now

***SCIENTIFIC ACTIVITIES:***

 ***Research Projects:***

**a) In-House Projects**

1. Development and evaluation of the performance of air lift pumps

2. Hybrid Renewable Energy Systems for Remote Communitues

3. Developing a Mathematical Simulation Model for Microbiological Hydrogen Production.

4. Using Natural Gas and Hydrogen as a fuel for Vehicles

5. Development of Hydrogen Storage Systems.

6. Design and Manufacture os Small Scale Wind Generator for Some Remote Sites in Egypt

7. New design of Renewable Energy System for Rural Areas

**b) Collaboration Projects:**

1. Application of integrated Wind/Diesel energy system for community development in Sinai. (Contract with Academy of Scientific Research & Technology)
2. Water Disinfection using Renewable Energy Sources. (Collaboration with Germany)
3. Photovoltaic Dissamination in Egypt. (Collaboration with Austria)
4. Environment-Frindly Hybrid Energy System for Remote Community. (Collaboration with Poland)
5. An Integrated Approach to Hydrogen Production and Seawater desalination Using Renewable Resources. (Partenership with USA)
6. Cost Effective of Renewable Energy for Rural Areas in Mediterranian Region. (Collaboration Project funded by EU )
7. Technological and Engineering Development for the Production of Hollow Fiber Membrane for Water Desalination.(International Project)

 *Teaching Experience*

 ***University Courses:***

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| --- | --- | --- |
| **Operations Research** | Benha Higher Institute of TechnologyAl-Fayyoum Faculty of EngineeringMisr University For Science and Technology | 1996- 20032006-20082009- 2011 |
| **Introduction to Computers** | Misr University For Science and Technology | 1998-1999 |
| **Industrial Management** | Al-Fayyoum Faculty of Engineering | 2006-2008 |
| **Project Management** | Canadian International College (CIC)High Institute for Engineering (CSC)  | 2006-20072014-2015 |
| **Marketing Management** | Canadian International College (CIC) | 2007-2009 |
| **Operations Research** | Misr University For Science and Technology | 2009-2010 |
| **Production Planning & Control** | Al-Fayyoum Faculty of Engineering | 2006-2008 |
| **Introduction to Management** | Misr University For Science and Technology | 2009-2014 |
| **Analysis of Inventory Systems**   | Misr University For Science and Technology | 2009-2014 |
| **Modelling & Simulation** | Misr University For Science and Technology | 2009-2014 |
| **Production Planning&Control-1** | High Institute for Engineering (CSC)Canadian International College (CIC) | 2014-20152015-2017 |
| **Production Planning&Control-2** | Canadian International College (CIC) | 2014-2017 |
| **Industrial Systems Simulation** | Canadian International College (CIC) | 2014-2017 |
| **Productivity Enhancement Methods** | Canadian International College (CIC) | 2015-2017 |
| **Engineering Economics** | Canadian International College (CIC) | 2015-2017 |
| **Advanced Engineering Economics** | Canadian International College (CIC) | 2015-2017 |

***Training Courses:***

Simulation Technique NRC Trainning Centre

Energy Conservation and Auditing Militry Production Authority

Energy Saving and Audit NRC Trainning Centre

Renewable Energy Systems NRC Trainning Centre

Project Management  NRC Trainning Centre

Managerial Skills NRC Trainning Centre

 ***Scientific Supervision:***

***Participating in the supervision of researches leading to M.Sc. and Ph.D. degrees:***

***Seven Granted M. Sc. degrees, titled:***

1. Performance and Techno-Economic Analysis of Hybrid Wind/Solar/Diesel System with Hydrogen Storage
2. Group Scheduling
3. Effect Of Cutting Parameters and Workpiece Material On Tool Life
4. Stydy of Layered Nano Materials for Hyrogen Storage Application
5. Control Unit for a Hybrid Renewable Energy System
6. Optimization of Urban Wind Turbine Systems Considering Externalities
7. Advanced Energy Management Sterategy for Poly-Generation Energy System.

***Three granted Ph.D. degree, titled***

1. Environmental Impacts Evaluation of Renewable Energy Systems
2. Optimal Design of Power Transmission Shafts Using Functionally Graded Materials
3. Design and Performance Evaluation of Renewable Energy Based Mivro Grid System with Energy Storage

***Participation in Conferences:***

1. Third Mechanical Power Engineering Conference, 1986.

2. Second International Conference on Desert Development, 1987.

3. Al-Azhar Engineering 3rd Conference, Cairo, Egypt, 1993.

4. Third Renewable Energy Congress, Reading, UK, 1994.

5. Al-Azhar Engineering 4th Conference, Cairo, Egypt, 1995.

6. 4 th Conference on Applications of Solar and Renewable Energy, Cairo, Egypt, 1996.

7. Fifth Renewable Energy Congress, Florence, Italy. (1998)

8. Seventh Cairo University International MDP Conference, Cairo, Egypt, 2000.

9. Symposium on "Photovoltaic Electricity from the Sun", Vienna, Austria, 2002

10. 4th European Consfernce on PV-Systems, Glyfada, Greece (2008)

11. Workshop on New and Renewable Energy for Industrial Development in Partnership with Egypt, "Egypt-Japan Year for Science and Technology",7th of July 2008.

12. Final Conference of the MEDRES Project," Cost-Effective of Renewable Energy for Rural Areas in Mediterranian Region, Cairo, Egypt, 2009.

13. SEPA- DESERTIC International Conference, Giessen, Germany, Sep. 17-19, 2012.

14. International Conference of Aeronotical and Mechanical Engineering, Londom, 23-26 Sept. 2014

**LIST OF SOME PUBLICATIONS**

1. *El-Mallh, A., Shalaby, M.A., and* ***Badr, M. A***., “ ***A Model to Estimate Wind Power at Selected Sites in Egypt***”, Proc. of 6th ICMPE, Cairo , Dec. 1986.

2. *Shalaby, M.A., El-Mallah, A., and* ***Badr M.A****.,* ***“ Simulation of The Performance of Small Size Wind Turbine System for Houshold Loads”***. The 2ndInt. Conference for Desert Development. Cairo, Jan. 1987.

3. *El-Mallah, A., Shalaby, M.A., and* ***Badr, M. A*.**, ***“A Stochastic Simulation Model For A Hybrid Renewable Energy System.Supplying A Remote Community”***, Al-Azhar 3rd Int. Conference, vol.7, pp 396, Dec. 1994., Dec. 1994.

4. *Shalaby, M.A., and* ***Badr, M. A***. “ ***A Response Surface Optimization Methodology For A Wind -Diesel Energy System.”***, 3rd World Renewable Energy Congress, vol.3, **Reading, UK**, Sep.1994.

5. *Abed, K.A.,* ***Badr, M. A****., and El-Mallah, A.,* ***“Off-Design Performance of Small Wind Turbine”***, Cairo, Int. Conference on Energy, Development, and Environment**, Egypt**, Oct. 1994.

6*. El-Mallah, A., Abed, K.A.,* ***Badr, M. A****.*, ***“ Effect of Using Renewable Energy Sources On The Reduction of CO2 Emission.”,*** Solar Energy Society, **Harare**, 1995.

7. *Khattab, N.M. and* ***Badr, M. A****.,* ***“Economic Evaluation of All Year Round Solar Dryer”***, Proc. of Al-Azhar Engineering 4th Conference,vol.7 Cairo, **Egypt**, Dec.1995.

8. *Hanafi, A.S.,* ***Badr, M. A****., El-Mallah, A.A., and Ibrahim, M.I.,* “***Performance Analysis of Wind/Solar/Diesel system With Hydrogen Storage***”, 11th World Hydrogen Energy Conference, **Germany**, June 1996.

9. *Ibrahim,M.I., Zacharias,P., and* ***Badr, M. A***., ***“ Performance Analysis and Sizing of an Integrated Energy System Using Long Term Storage”***, 14th EUPVSEC and Exhibition, **Spain**, July 1997.

10. *Ibrahim, S.M.A., El-Kordy, M.N.,* ***Badr, M. A****., Abed, K.A., and El-Mallh, A*., “***Environmental Impact Evaluation of Wind Energy Exploitation***”, Proc. of Renewable Energy Congress, Florence, **Italy**, 1998.

11. ***Badr, M. A***., ***“Generalization of The Performance of Medium Size Variable Speed Operation Wind Turbines***”, Journal of Egyptian Society of Engineers, vol.38, No. 2, 1999.

12*. El-Kordy, M.N,* ***Badr, M. A.,*** *Abed, K.A., and El-Mallah, and Ibrahim, S.M.A*., “***Environmental Impact Evaluation Assessment Matrices for Electricity Generation Systems***”, ”, Journal of Egyptian Society of Engineers, vol.39, No. 3, 2000.

13*. El-Kordy, M.N****, Badr, M. A****., Abed, K.A., and Ibrahim, S.M.A*., “***Economical Evaluation of Electricity Generation Considering Externalitiss”***, Journal of Egyptian Society of Engineers, vol.39, No. 4, 2000.

14. *A. S. Hozayyin,* ***M. A. Badr*** *and M. E. Hellal*, " ***An Investigation of Group Scheduling Heuristics in a Flow-Line Cell"***, Proceedings of Current Advances in Mechanical Design and Production VII, Cairo, Egypt, 2000

15. *El Chazly, N. and* ***Badr, M. A****.,* “***Renewable Energy Options and Environmental Benefits***”, Sharja Solar Energy Conference”, Feb. 2001.

16. *Maalawi, K.Y., and* ***Badr, M. A*.,** “***A Practical Approach for Selecting Optimum Wind Rotors”,*** Renewable Energy Journal, vol.28, pp 803-822, 2003.

17. *Maalawi, K.Y., and* ***Badr, M. A****.,”****Key-Design Equations of Electricity-Generating Wind Turbines”***, Journal of Egyptian Society of Engineers, vol.43, No 1, 2004

18. *K. A. Abed and* ***M. A. Badr***, “***Off-Desin Performance Characteristics of Wind Turbines***”, World Renewable Energy Congress IX, Florence, Italy. August 2006.

19. *M.E. Abd El-Samie,* ***M.A.Badr****, A.M. Abou El-Fotooh*, **" *Microbial Hydrogen Production"*,** Journal of Applied Sciences Research, 2007.

20. *M. A. Ziada,* ***M. A. Badr***; “***Turbulence- characteristics of the Flow Field under air cushion plenum chambers"****,* 3rd. Engineering Research Division Conferemce, NRC, March-2008.

21. ***M. A. Badr****, K. A. Abed, A. A. El-Mallah and M. I. El Anwar*, **“*Optimal Design of Hybrid Systems with Battery Storage****”.* Proceeding of the 4th European Consfernce on PV-Systems, Glyfada, Greece, May- 2008*.*

22. *Karam Y. Maalawi1* ***& M. A. Badr***; “***Optimal Frequency Design of a Variable-Pitch Wind Turbine Blade*”**. Proceedings of WREC X, Glasgow, Scotland, July-2008.

23. *Azza Hafez, Maaly Khedr,* ***Mervat Badr****, Kamel El Khateeb, Hanaa , Saied El Hallaj Fouad Taymor*, "***Energy In Egypt: Current Status And Future Prospects",*** Proceedingss of the Global Conference on Global Warming-2008 (GCGW-08), Istanbul, Turkey, July 2008

24. M. A. Badr, K. A. Abed, A. A. El-Mallah***,"Investigation of Socio-Economic and Energy Indicators in the Context of Environmental Impacts: Egyptian Case Study***", Engineering Research Journal (ERJ), Menoufia University, Vol. 32, No. 3 July 2009.

25. ***M. A. Badr****, K. A. Abed, A. A. El-Mallah****,"*** ***Airborn Emissions from Wind Energy and Photovoltaic Life Cycle”,*** Engineering Research Journal (ERJ), Menoufia University, Vol. 32, No. 3 July 2009.

26. *Karam Y. Maalawi &* ***M. A. Badr*,** ***" Design Optimization of Mechanical Elements and Structures: a Review with Application"***, Journal of Applied Sciences Research, 2009.

27. *Karam Y. Maalawi &* ***M. A. Badr***, “***Frequency Optimization of a Wind Turbine Blade in Pitching Motion”***, Accepted for publication in Journal of Power and Energy, 2010.

28. [*El-Hossainy, T.M.*](http://www.scopus.com/authid/detail.url?origin=resultslist&authorId=23994834100&zone=)*,* [*El-Zoghby, A.A.*](http://www.scopus.com/authid/detail.url?origin=resultslist&authorId=6505762482&zone=)*,* [***Badr, M.A.***](http://www.scopus.com/authid/detail.url?origin=resultslist&authorId=7101945697&zone=)*,* [*Maalawi, K.Y.*](http://www.scopus.com/authid/detail.url?origin=resultslist&authorId=6602887672&zone=)*,* [*Nasr, M.F.*](http://www.scopus.com/authid/detail.url?origin=resultslist&authorId=7102226708&zone=) “[***Cutting parameter optimization when machining different materials***](http://www.scopus.com/record/display.url?eid=2-s2.0-78650362312&origin=resultslist&sort=plf-f&src=s&st1=Maalawi&sid=Ae4V4-P-dNFGGWr-G9EwLQK%3a40&sot=b&sdt=b&sl=156&s=AUTHOR-NAME%28Maalawi%29+AND+DOCTYPE%28ar%29+AND+SUBJAREA%28MULT+OR+CENG+OR+CHEM+OR+COMP+OR+EART+OR+ENER+OR+ENGI+OR+ENVI+OR+MATE+OR+MATH+OR+PHYS%29+AND+PUBYEAR+AFT+2009&relpos=1&relpos=1&searchTerm=AUTHOR-NAME(Maalawi)%20AND%20DOCTYPE(ar)%20AND%20SUBJAREA(MULT%20OR%20CENG%20OR%20CHEM%20OR%20COMP%20OR%20EART%20OR%20ENER%20OR%20ENGI%20OR%20ENVI%20OR%20MATE%20OR%20MATH%20OR%20PHYS)%20AND%20PUBYEAR%20AFT%202009)”, [Materials and Manufacturing Processes](http://www.scopus.com/source/sourceInfo.url?sourceId=21054&origin=resultslist) 25 (10), pp. 1101-1114, 2010.

29. [*Ismail, N.*](http://www.scopus.com/authid/detail.url?origin=resultslist&authorId=35746143500&zone=)*,* [*Temerk, Y.M.*](http://www.scopus.com/authid/detail.url?origin=resultslist&authorId=6603892808&zone=)*,* [*El-Meligi, A.A.*](http://www.scopus.com/authid/detail.url?origin=resultslist&authorId=35299026700&zone=)*,* [***Badr, M.A****.*](http://www.scopus.com/authid/detail.url?origin=resultslist&authorId=35745517800&zone=)*,* [*Madian, M.*](http://www.scopus.com/authid/detail.url?origin=resultslist&authorId=35746637400&zone=), “[***Synthesis and characterization of MnPS3 for hydrogen sorption***](http://www.scopus.com/record/display.url?eid=2-s2.0-77953166482&origin=resultslist&sort=plf-f&src=s&st1=N.+Ismail&sid=Ae4V4-P-dNFGGWr-G9EwLQK%3a300&sot=b&sdt=b&sl=204&s=FIRSTAUTH%28N.+Ismail%29+AND+DOCTYPE%28ar%29+AND+SUBJAREA%28MULT+OR+MEDI+OR+NURS+OR+VETE+OR+DENT+OR+HEAL+OR+MULT+OR+CENG+OR+CHEM+OR+COMP+OR+EART+OR+ENER+OR+ENGI+OR+ENVI+OR+MATE+OR+MATH+OR+PHYS%29+AND+PUBYEAR+AFT+2009&relpos=19&relpos=19&searchTerm=FIRSTAUTH(N.%20Ismail)%20AND%20DOCTYPE(ar)%20AND%20SUBJAREA(MULT%20OR%20MEDI%20OR%20NURS%20OR%20VETE%20OR%20DENT%20OR%20HEAL%20OR%20MULT%20OR%20CENG%20OR%20CHEM%20OR%20COMP%20OR%20EART%20OR%20ENER%20OR%20ENGI%20OR%20ENVI%20OR%20MATE%20OR%20MATH%20OR%20PHYS)%20AND%20PUBYEAR%20AFT%202009)”, [Journal of Solid State Chemistry](http://www.scopus.com/source/sourceInfo.url?sourceId=26972&origin=resultslist) 183 (5), pp. 984-987, 2010.

30. *K. A. Abed, A.A. Almalllh and* ***M. A. Badr***, “***Energy Efficiency Uses in Peri-Urban Regions: Egyptian Case Study***”, Advances in Environment, Biotechnology and Biomedicine, 2012 (ISBN: 978-1-61804-122-7).

31. *A. Bahgat, K.A. Abed,* ***M.A. Badr****, M. A. El-Bayoumy and A. A. Ragheb*, **“*Experimental Results of Computer Monitoring of PV-Based Energy System,*** World Renewable Energy Congress WREC XIII, London, UK, 3-8 Aug. 2014.

32. ***M.A. Badr****, A.N. Mohib and M.M. Ibrahim,“****Small Wind Turbine Hybrid System for Remote Application: Egyptian Case Study***”International Journal of Mechanical, Aerospace, Industrial and Mechatronics Engineering Vol:8 No: 9, Sep. 2014.

33. ***M. A. Badr****, A. N. Mohib, M. M. Ibrahim*, "***Small Wind Turbine Hybrid System for Remote Application: Egyptian Case Study***". World Academy of Science, Engineering and Technology, International Journal of Mechanical, Aerospace, Industrial, Mechatronics and Manufacturing Engineering Vol. 8, No. 9, 2014

34. *K.A. Abed,* ***M.A. Badr****, Enas R. Shouman*, “***Cost Analysis of Energy Efficient Domestic Refrigerators***”, International Research Journal of Electronics & communication Engineering. Volume1, Issue 4 of May 2015. [www.irjece.com](http://www.irjece.com) - ISSN: 2395-0587

35. *M.F. Nasr, A.A. El-Zoghby, K.Y. Maalawi, B.S. Azzam and* ***M.A. Badr***, “***Torsional Buckling Optimization of Composite Drive Shafts***”***,*** World Applied Sciences Journal 33 (3): 517-524, 2015- ISSN 1818-4952

36. *Enas R. Shouman, E.T. El Shenawy and* ***M.A. Badr***, “***Economics Analysis of Diesel and Solar Water Pumping With Case Study Water Pumping for Irrigation in Egypt”,*** International Journal of Applied Engineering Research, ISSN 0973-4562 Vol. 10 No.5 pp. 3979-3982, 2015*.* http://www.ripublication.com/ijaer.htm

1. *M.A. Fouad,* ***M.A. Badr****, M.M. Ibrahim*, "***A Study of an Egyptian Micro-Grid System with Economic Appraisal***", Journal of Engineering and Applied Science, Vol.63, No3, PP. 183-199. June 2016.
2. N. M. Khattab, M. A. Badr, K. Y. Maalawi, E. T. El Shenawy, H. H. El Ghetany, M. M. Ibrahim, "Hybrid Renewable Energy System For Water Desalination: A Case Study For Small Green House Hydroponic Cultivation In Egypt", ARPN Journal of Engineering and Applied Sciences, NOVEMBER 2016 , 11, (21)
3. *Mahmoud A. Fouad,* ***M.A. Badr****, M.M. Ibrahim*, "***Economic Evaluation of Micro-Grid System (On/Off Grid): Egyptian Case Study***", International Journal of Scientific & Engineering Research, Volume 8, Issue 2, February-2017.
4. *M.A. Fouad,* ***M.A. Badr****, M.M. Ibrahim*, "***Modeling of Micro-Grid System Components Using Matlab/Simulink***", Global Scientific Journals, Volume 5, Issue 5, May 2017.
5. *Mahmoud A. Fouad,* ***M.A. Badr****, Z. S. Abd El Rehim, Taher Halawa, M.M. Ibrahim*, "***Effect of Some Parameters on the Cost of Energy Generated from Renewable Energy Based Micro Grid System***", Journal of Scientific and Engineering Research (JSER), ISSN:2394-2630, Vol 4, No. 9, 2017.
6. *Tewfik S, Abulnour A, Shaalan H,* [*El-Anwar M*](https://www.mendeley.com/authors/36672764400)*, Ali S, Abed K, Badr M, Sorour M*, **“**[***Analysis of some engineering parameters relevant to the performance and reliability of hollow fiber spinning system***](http://www.mendeley.com/research/analysis-some-engineering-parameters-relevant-performance-reliability-hollow-fiber-spinning-system)*”,*ARPN Journal of Engineering and Applied Sciences 12(15), 2017.
7. ***M. A. Badr****, M. M. El Sayed, A. Aref, A. Salah*, "***Improving Material Flow in a Mixed-Line Production Facility: A Case Study in Washing Machine Factory*",** 4th International Conference of Engineering Division NRC-ICED 2018
8. *K.A. Abed, A. Bahgat,* ***M.A. Badr****, M. A. El-Bayoumi and A. A. Ragheb*, **“*Experimental Study of Battery of Battery State of Charge Effect on Battery Output Power in PV Energy System",*** ARPN Journals (JEAS), Volume 2, 2018.
9. *M. A. Fouad,* ***M. A. Badr****, Taher Halawa, M. M. Ibrahim, "****Technical and Economic Analysis of Smart Micro-Grid Renewable Energy System: An Applicable Case Study",*** Conference Proceedings, Bangkok Thailand Dec 13-14, 2018, 20 (12) Part VI
10. *M.A. Fouad,* ***M.A. Badr****, M.A. El Bayoumi, M.M. Ibrahim, "****Experimental Investigation Results Super-capacitors vs. Batteries****",* Journal of Scientific and Engineering Research 212 Journal of Scientific and Engineering Research, 2019, 6(1):212-227. Available onlinewww.jsaer.com
11. *M.A.Fouad,* ***M.A.Badr****, M.M.Ibrahim,* ***"Economic Evaluation of Micro-Grid System (On/Off Grid): Egyptian Case Study",***International Journal of Scientific & Engineering Research, Volume 8, Issue 2, February-2017
12. *M.A.Fouad,* ***M.A. Badr****, M.M.Ibrahim, "****Modeling of Micro-Grid System Components Using Matlab/Simulink",***Global Scientific Journals, Volume 5, Issue 5, May 2017.
13. *M.A.Fouad,* ***M.A. Badr****, Z.S. Abd El-Rehim, Taher Halawa and M.M. Ibrahim, "****Effect Of Some Parameters On the Cost Of Energy Generated From Renewable Energy Based Micro Grid System****",* Journal of Scientific and Engineering Research, Volume 4, Issue 9, Sep. 2017.
14. *M.M.Ibrahim, M.A. Fouad and* ***M.A.Badr****, "****Design of Micro-Grid Renewable Energy System with Energy Storage****",* ISBN: 978-620-2-30810-6, Scholars' Press Academic Publishing, Germany, 2018.
15. *M.A.Fouad,* ***M.A.Badr****, Z.S. Abd El-Rehim, Taher Halawa, Mahmoud Bayoumi and M.M.Ibrahim, "****Technical and Economic Analysis of Smart Micro-Grid Renewable Energy System: Applicable Case Study"****,*Conference Proceeding of 20th International Conference of Engineering Applications and Renewable Energy, Bangkok, Thailand, Nov.2018*.*
16. *M.A. Fouad,* ***M.A.Badr****, Mahmoud Bayoumi and M.M.Ibrahim, "****Experimental Investigation Results Super-capacitors vs. Batteries****",* Journal of Scientific and Engineering Research, Volume 6, Issue 1, 2019.
17. *Amal ElBerry,* ***M.A.Badr*** *and Marwa M. Ibrahim, "****Reliability Analysis of Gas Turbine Power Plant Based on Failure Data****",* International Journal of Mechanical & Mechatronics Engineering IJMME-IJENS, Volume 20, Issue 2, PP.13-25, 2020.
18. ***“Modelling, Simulation and Optimization of Wind Farms and Hybrid Systems***," IntechOpen 978-1-78985-612-5.

 <https://www.intechopen.com/books/modeling-simulation-and-optimization-of-wind-farms-and-hybrid-systems>