

12. 8 Optimal Power Control using Multi-objective Optimization Techniques

12.8.1 Contributing Faculty Members

1. Kamal K. Mandal (KKM), Power Engineering Department, Age – 49yrs, Journal Publications – 17, Conference Publications – 41, H Index – 6, Cumulative Impact Factor – --, Total Citations – 139, Awarded and ongoing doctoral thesis guidance – 05, Awarded and ongoing Masters thesis guidance –25.

12.8.2 Relevant Projects in Last 10years including the Ongoing Projects:

Project Title	Sponsoring Agency	Members	Grant Value (Rs in Lakh)	Duration
Optimal Power Control using Multi-objective Optimization Techniques.	UGC UPE II	KKM	7.04	2012-2017

12.8.3 Relevant Publications in Last 5years (2008-2013)

1. **K.K. Mandal**, N. Chakraborty, “Parameter Study of Differential Evolution based Optimal Scheduling of Hydrothermal Systems”, Journal of Hydro-environment Research 7, 2013, pp.72-80.
2. Syamasree Biswas (Raha), **Kamal Krishna Manadal**, and Niladri Chakraborty, “Simulated Annealing Based Real Power Loss Minimization Aspect for a Large Power Network,” International Conference on Swarm, Evolutionary and Memetic Computing - 2013 (SEMCCO 2013), December 19 – 20, 2013, Lecture Notes on Computer Science (LNCS) 8297, Springer, pp. 345-353, 2013.
3. S. Kumar, D. Pal, **K. K. Mandal**, and Niladri Chakraborty, “Performance Study of a New Modified Differential Evolution Technique Applied for Optimal Placement and Sizing of Distributed Generation,” International Conference on Swarm, Evolutionary and Memetic Computing -2013 (SEMCCO 2013), December 19 – 20, 2013, Lecture Notes on Computer Science (LNCS) 8297, Springer, pp. 189-198, 2013.
4. Bidishna Bhattacharya¹, **Kamal K. Mandal**, Niladri Chakraborty, “A New Improved Knowledge Based Cultural Algorithm for Reactive Power Planning,” International Conference on Swarm, Evolutionary and Memetic Computing -2013 (SEMCCO 2013), December 19 – 20, 2013, Lecture Notes on Computer Science (LNCS) 8297, Springer, pp. 78-87, 2013.
5. Sandeepan Majumdar, **K.K. Mandal**, Niladri Chakraborty, “Optimal Sizing of a Photovoltaic System for Peak Power Shaving Application,” IEEE International Conference on Circuit, Power and Computing Technologies 2013 (ICCPCT 2013), Nagercoil, India, pp. 350–355, 2013.
6. Syamasree Biswas (Raha), Prof. Niladri Chakraborty, **Dr. Kamal Krishna Mandal**, “Differential evolution technique with random localization for tuned reactive power dispatch problem,” Electric Power Components and Systems, 41: pp.500–518, 2013.

7. Syamasree Biswas (Raha), **K.K. Mandal**, N. Chakraborty, "Constriction Factor based Particle Swarm Optimisation for Analyzing Tuned Reactive Power Dispatch," *Frontiers in Energy*, Springer June 2013, Volume 7, Issue 2, pp 174-181.
8. S. Kumar, S. Sau, D. Pal, B. Tudu , **K.K. Mandal**, and N. Chakraborty, "Parametric Performance Evaluation of Different Types of Particle Swarm Optimization Techniques Applied in Distributed Generation System," International conference on Frontier in Intelligent Computing Theory and Application (FICTA 2012), December 22 – 23, 2012, Bhubaneswar, India, *Advances in Intelligent and Soft Computing*, 2013, Volume 132, Springer, pp.349-356.
9. **Kamal K. Mandal**, D. Jana, B. Tudu ,B. Bhattacharya, "A New Improved Particle Swarm Optimization Technique for Reactive Power Compensation of Distribution Feeders," International conference on Frontier in Intelligent Computing Theory and Application (FICTA 2012), December 22 – 23, 2012, Bhubaneswar, India, *Advances in Intelligent and Soft Computing*, 2013, Volume 132, Springer, pp.321-328.
10. S. Biswas (Raha), **K.K. Mandal**, and N. Chakraborty, "Modified Differential Evolution based Multi-Objective Congestion Management in Deregulatory Power Environment," *International Journal of Electrical, Electronics and Computer Engineering* **1**(2): 2012, pp.93-97.
11. **K.K. Mandal**, N. Chakraborty, "Daily Combined Economic Emission Scheduling of Hydrothermal Systems with Cascaded Reservoirs Using Self Organizing Hierarchical Particle Swarm Optimization Technique," *Expert Systems with Applications* **39**, 2012, pp.3438-3445.
12. Bidishna Bhattacharya, **Kamal K.Mandal**, Niladri Chakravorty, "Cultural Algorithm Based Constrained Optimization for Economic Load Dispatch of Units Considering Different Effects," *International Journal of Soft Computing and Engineering (IJSCE)*, ISSN: 2231-2307, Volume-2, Issue-2, May 2012, pp.45-50.
13. Bidishna Bhattacharya, **Kamal K.Mandal**, Niladri Chakravorty, "A Multiobjective Optimization Based on Cultural Algorithm for Economic Dispatch with Environmental Constraints," *International Journal of Scientific & Engineering Research*, Volume 3, Issue 6, June-2012 1 ISSN 2229-5518, pp. 1-9.
14. **Kamal K. Mandal** and Debashis Jana, "Reactive Power Planning for Distribution Feeders Using a Novel Improved Self Adaptive Particle Swarm Optimization Technique," *CIIT International Journal of Artificial Intelligent Systems and Machine Learning*, Vol 4, No 6, pp. 409 – 415, June 2012. Print: ISSN 0974 – 9667 & Online: ISSN 0974 – 9543, Issue: June 2012.
15. **Kamal Krishna Mandal**, Bidishna Bhattacharya, Bhimsen Tudu1, and Niladri Chakraborty, "A New Improved Self Adaptive Particle Swarm Optimization Technique for Economic Load Dispatch," *International Conference on Swarm, Evolutionary and Memetic Computing -2012 (SEMCCO 2012)*, December 20 – 22, 2012, Bhubaneswar, Lecture Notes on Computer Science (LNCS) 7677, Springer, pp. 215-223, 2012.
16. Bhimsen Tudu, Preetam Roy, Sajjan Kumar, Diptendu Pal, **Kamal Krishna Mandal**, and Niladri Chakraborty, "Techno-Economic Feasibility Analysis of Hybrid Renewable Energy System Using Improved Version of Particle Swarm Optimization," *International*

- Conference on Swarm, Evolutionary and Memetic Computing -2012 (SEMCCO 2012), December 20 – 22, 2012, Bhubaneswar, Lecture Notes on Computer Science (LNCS) 7677, Springer, pp. 116-123, 2012.
17. Bidishna Bhattacharya¹, **Kamal Krishna Mandal**, Niladri Chakraborty, “Reactive Power Optimization Using Hybrid Cultural Algorithm,” International Conference on Swarm, Evolutionary and Memetic Computing -2012 (SEMCCO 2012), December 20 – 22, 2012, Bhubaneswar, Lecture Notes on Computer Science (LNCS) 7677, Springer, pp. 106-115, 2012.
 18. D. Pal, S. Kumar, B. Tudu, **K.K. Mandal**, and N. Chakraborty, “Efficient and Automatic Reconfiguration and Service Restoration in Radial Distribution System Using Differential Evolution,” International conference on Frontier in Intelligent Computing Theory and Application (FICTA 2012), December 22 – 23, 2012, Bhubaneswar, India, Advances in Intelligent and Soft Computing, 2013, Volume 132, Springer, pp.365-372.
 19. Debashis Jana, **Kamal K. Mandal**, “A New Optimal Solution to Environmentally Constrained Economic Dispatch Using Modified Real Coded Genetic Algorithm,” International conference on Frontier in Intelligent Computing Theory and Application (FICTA 2012), December 22 – 23, 2012, Bhubaneswar, India, International conference on Frontier in Intelligent Computing Theory and Application (FICTA 2012),, Volume 132, Springer, pp.329-337.
 20. Bidishna Bhattacharya, **Kamal Mandal** and Niladri Chakraborty, “Knowledge Based Evolutionary Programming: Cultural Algorithm Approach for Constrained Optimization,” Proceedings of the International Conference on Information Systems Design and Intelligent Applications 2012 (INDIA 2012) held in Visakhapatnam, India, January 2012, Advances in Intelligent and Soft Computing, 2012, Volume 132/2012, Springer, pp.93-101.
 21. **Kamal K. Mandal** , Debashis Jana, “A new self adaptive particle swarm optimization technique for reactive power compensation in distribution systems,” International Conference on Computation of Power, Energy, Information and Communication_2012(ICCPEIC-2012), Tamilnadu-603319, INDIA, April 18-19, 2012. pp.1-8.
 22. Bidishna Bhattacharya, **K.K.Mandal**, N.Chakraborty, “A Hybrid Cultural Approach For Combined Economic and Emission Dispatch,”Engineering Sustainable Solutions, INDICON 2011, Hyderabad, 16-18 Dec, 2011. Digital Object Identifier : 10.1109/INDCON.2011.6139595.
 23. **Kamal K. Mandal**, Bidisna Bhattacharya, Bhimsen Tudu and N. Chakravorty, “Emission Constrained Economic Dispatch Using Logistic Map Adaptive Differential Evolution”, Proceedings of the International Conference on Information Systems Design and Intelligent Applications 2012 (INDIA 2012) held in Visakhapatnam, India, January 2012 Advances in Intelligent and Soft Computing, 2012, Volume 132/2012, Springer, pp.387-394.
 24. B. Tudu, S. Majumder, **K. K. Mandal**, N. Chakraborty, “Optimal unit sizing of stand-alone renewable hybrid energy system using bees algorithm,” IEEE International

- Conference on Energy, Automation and signal (ICEAS 2011) Dec. 28-30, 2011, Bhubaneswar, Orissa.,pp.1-6, Digital Object Identifier : 10.1109/ICEAS.2011.6147175.
25. **K. K. Mandal**, B. Bhattacharya, B. Tudu, N. Chakraborty, “A novel population-based optimization algorithm for optimal distribution capacitor planning,” in the IEEE International Conference on Energy, Automation and signal (ICEAS 2011) Dec. 28-30, 2011, Bhubaneswar, Orissa., pp.1-6. Digital Object Identifier : 10.1109/ICEAS.2011.6147075.
 26. B. Tudu, S. Majumder, **K.K. Mandal**, N. Chakraborty, “Comparative Performance Study of Genetic Algorithm and Particle Swarm Optimization Applied on Off-grid Renewable Hybrid Energy”, International Conference on Swarm, Evolutionary and Memetic Computing (SEMCCO 2011), Part I, LNCS, 7076, Springer, pp. 151-158.
 27. **K.K. Mandal**, N. Chakraborty, “Optimal Scheduling of Cascaded Hydrothermal Systems Using a New Improved Particle swarm Optimization Technique,” Smart Grid and Renewable Energy, 2011, 2, pp. 282-292.
 28. **K.K. Mandal**, N. Chakraborty, “Optimal Capacitor Placement in Distribution Systems using a New Improved Particle Swarm Optimization Technique,” International Journal of Applied Engineering Research, Vol 6. No. 5, 2011, pp. 1182-1188.
 29. **K.K. Mandal**, N. Chakraborty, “Optimal Hydrothermal Scheduling Using a Novel Population Based Optimazation Technique,” International Journal of Applied Engineering Research, Vol 6. No. 5, 2011, pp. 1112-1120.
 30. **K.K. Mandal**, N. Chakraborty, “Short-term Combined Economic Emission Scheduling of Hydrothermal Systems with Cascaded Reservoirs using Particle Swarm Optimization Technique,” Applied Soft Computing 11 (2011) pp.1295–1302.
 31. **K. K. Mandal**, B. Bhattacharya, B. Tudu, N. Chakraborty, “Logistic map adaptive differential evolution for optimal capacitor placement and sizing,” International Conference on Swarm, Evolutionary and Memetic Computing (SEMCCO 2011), Part I, LNCS 7076, Springer, pp. 68- 76.
 32. **K.K.Mandal**, B. Tudu, N. Chakraborty, “A new Improved Particle Swarm Optimization Technique for Daily Economic Generation Scheduling of Cascaded Hydrothermal Systems,” International Conference on Swarm, Evolutionary and Memetic Computing (SEMCCO 2010), Lecture Notes on Computer Science (LNCS) 6466, Chennai, Dec 16-18, 2010, pp. 680-688.
 33. V. Haldar, **K.K.Mandal**, N. Chakraborty, “Profit Maximization by Optimal Allocation of Capacitor in Radial Distribution System using Cultural Algorithm,” IEEE Proceeding of 9th International Power and Energy Conference, 2010 Singapore, Oct, 2010, pp. 356-361.
 34. **K.K.Mandal**, V. Haldar, N. Chakraborty, “Comparison of Different Variants of Differential Evolution applied to short-term economic generation scheduling of hydrothermal systems,” IEEE Proceeding of 9th International Power and Energy Conference, 2010 Singapore, Oct, 2010, pp.836-841.
 35. **K.K. Mandal**, M. Basu, N. Chakraborty, “Particle Swarm Optimization based Fuzzy Satisfying Method for Economic Environmental Dispatch of Hydrothermal Power

- Systems,” International Journal of Automation and Control, Vol 3, No.2/3, 2009, pp.216-229. Inderscience.
36. **K.K. Mandal**, N. Chakraborty, “Short-term Combined Economic Emission Scheduling of Hydrothermal Power Systems with Cascaded Reservoirs using Differential Evolution,” Energy Conversion and Management 50 (2009) pp. 97–104.
 37. **K.K. Mandal**, M. Basu, N. Chakraborty, “Particle Swarm Optimization technique based Short-Term Hydrothermal Scheduling,” Applied Soft Computing, Elsevier, No. 8, pp. 1392-1399, 2008.
 38. **K. K. Mandal**, N. Chakraborty, “Differential Evolution based Environmentally Constrained Economic Dispatch,” IEEE Conference & Exhibition on Control, Communication and Automation, Indian Institute of Technology, Kanpur December 11-13, 2008, IEEE INDICON 2008, pp. 471-476.
 39. **K. K. Mandal**, N. Chakraborty, “Combined Economic Emission Dispatch with Transmission Loss using Particle Swarm Optimization Algorithm,” International Conference on Power Electronics Drives & Power Systems (PowerCoin 2008), March 20-21, 2008 Salem, India, Vol I, pp. 89-94.
 40. **K. K. Mandal**, N. Chakraborty, “Application of Particle Swarm Optimization Technique to short-term Economic generation Scheduling of Hydrothermal,” International Conference on Power Electronics Drives & Power Systems (PowerCoin 2008), March 20-21, 2008 Salem, India, Vol I., pp. 69-74.
 41. **K.K. Mandal**, N. Chakraborty, “Differential Evolution Technique based Short-Term Economic Generation Scheduling of Hydrothermal Systems,” Electric Power Systems Research, No. 78, pp. 1972-1979, 2008.
 42. **K.K. Mandal**, N. Chakraborty, “Effect of Control Parameters on Differential Evolution based Combined Economic Emission Dispatch with Valve-Point Loading and Transmission Loss,” International Journal of Emerging Power Systems, Vol. 9, No. 4 . 2008.

12.8.4 Facilities Available

Power System Simulation Laboratory equipped with MATLAB 7, ETAP etc.

12.8.5 Ongoing Work under UPE II – 2012-14

1. Title: Efficient and Automatic Reconfiguration and Service Restoration in Radial Distribution System Using Differential Evolution

Authors: D. Pal, S. Kumar, B. Tudu, K. K. Mandal, and N. Chakraborty

Journal/conference: International conference on Frontier in Intelligent Computing Theory and Application (FICTA 2012), December 22-23, 2012, Bhubaneswar, India, Advances in Intelligent and Soft Computing, 2013, Volume 132, Springer, pp. 365-372.

2. Title: Multi-Objective Congestion Management Using Hybrid Differential Evolution In A Deregulated Power System

Authors: D. Pal, S. Kumar, K. K. Mandal, and N. Chakraborty

Journal/Conference: Accepted and under process of publication International Conference on Control, Instrumentation, Energy and Communication (CIEC- 14), January 31-February 2, Kolkata 2014, IEEE Xplore.

3. Title: Chaotic Differential Evolution Algorithm for Optimal Reactive Power Planning

Authors: S. Kumar, D. Pal, K. K. Mandal, and N. Chakraborty

Abstract:

Optimal reactive power planning is one of the fundamental issues in power system operation and control. This paper presents a modified search algorithm based on differential evolution and chaos theory to find optimal location and size of the reactive power compensating devices. Reactive power planning is a mixed integer, highly non-linear optimization problem with several equality and inequality constraints. It is well known fact that generator voltages, tap changer transformer settings and compensating devices at different load points can affect the voltage profile in the whole system and there by the loss of overall system. The proposed method is applied on IEEE 30 bus systems to demonstrate its effectiveness. The results obtained by the proposed method are compared with that obtained by several other population based heuristic techniques. It is found that the proposed algorithm can produce better results in terms of reduced loss, better voltage profile and voltage stability.

Journal/Conference: Communicated to journal "**Swarm and Evolutionary Computation**" of Elsevier.

Status: Submitted for publication after two Technical Reviews.

12.8.6 Work plan during 2014-17

1. Investigation on Multi-objective Power Control in a deregulated market.
2. Application of different soft computing techniques for optimal power control
3. Investigation on new soft computing techniques for power system optimization..