

Lecture Notes in Electrical Engineering 1107

Om Hari Gupta  
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# Soft Computing Applications in Modern Power and Energy Systems

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# Soft Computing Applications in Modern Power and Energy Systems

Select Proceedings of EPREC 2023, Volume 4

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Dr. Padhy is a well awarded and honoured scholarly professional at the national and international levels.

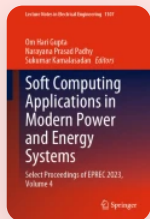
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# Chaotic Quasi-Oppositional Differential Search Algorithm for Transient Stability Constraint Optimal Power Flow Problem

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## Abstract

In this research work, the concept of Chaotic Quasi-Oppositional Differential Search Algorithm (CQODSA) has been successfully applied to address the transient stability constraint optimal power flow problem. The effectiveness of the suggested algorithm has been evaluated on WSCC 3-generator, 9-bus system and New England 10-generator, 39-bus system. The recommended algorithm’s implementation has been evaluated for different fault conditions with the purpose of demonstrating CQODSA’s applicability in this versatile scenario. By contrasting the findings with those of other well-known algorithms, the superiority of the established method has been proven.

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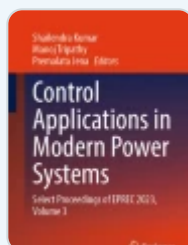
```

for k = 1 to nv
    if rand1(0,1) > Cr or k == kmax
        Ri(k) = Xg(k) + F(Xg(k) - Xc(k))
    else
        Ri(k) = Xj(k)
    end
end

```

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## References

1. Dommel HW, Tinney WF (1968) Optimal power flow solutions. IEEE Trans Power Apparatus Syst (10):1866–1876

[Google Scholar](#)

2. Lobato E, Rouco L, Navarrete MI, Casanova R, Lopez G (2001) An LP-based optimal power flow for transmission losses and generator reactive margins minimization. In: 2001 IEEE Porto power tech proceedings (Cat. No. 01EX502), vol 3. IEEE, p 5

[Google Scholar](#)

3. Momoh JA (1989) A generalized quadratic-based model for optimal power flow. In: Conference proceedings, IEEE international conference on systems, man and cybernetics. IEEE, pp 261–271

[Google Scholar](#)

4. Momoh JA, Zhu JZ (1999) Improved interior point method for OPF problems. IEEE Trans Power Syst 14(3):1114–1120

[Google Scholar](#)

5. Sun DI, Ashley B, Brewer B, Hughes A, Tinney WF (1984) Optimal power flow by Newton approach. IEEE Trans Power Apparatus Syst (10):2864–2880

[Google Scholar](#)

6. Yan X, Quintana VH (1999) Improving an interior-point-based OPF by dynamic adjustments of step sizes and tolerances. IEEE Trans Power Syst 14(2):709–717

[Google Scholar](#)

7. Momoh JA, El-Hawary ME, Adapa R (1999) A review of selected optimal power flow literature to 1993. II. Newton, linear programming and interior point methods. IEEE Trans Power Syst 14(1):105–111

[Google Scholar](#)

8. Pudjianto D, Ahmed S, Strbac G (2002) Allocation of VAR support using LP and NLP based optimal power flows. IEE Proc-Gen Trans Distrib 149(4):377–383

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9. Roy PK, Mandal D (2011) Quasi-oppositional biogeography-based optimization for multi-objective optimal power flow. *Electr Power Comp Syst* 40(2):236–256

[Article](#) [Google Scholar](#)

10. Abou El-Ela AA, Abido MA (1992) Optimal operation strategy for reactive power control. *Model Simul Control Gen Phys Matter Waves Electr Electron Eng* 41:19–19

[Google Scholar](#)

11. Jr Santos A, Da Costa GRM (1995) Optimal-power-flow solution by newton's method applied to an augmented lagrangian function. *IEE Proc-Gen Trans Distrib* 142(1):33–36

[Google Scholar](#)

12. De Carvalho EP, dos Santos Júnior A, Ma TF (2008) Reduced gradient method combined with augmented lagrangian and barrier for the optimal power flow problem. *Appl Math Comput* 200(2):529–536

[Google Scholar](#)

13. Capitanescu F, Wehenkel L (2013) Experiments with the interior-point method for solving large scale optimal power flow problems. *Electr Power Syst Res* 95:276–283

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14. Gaing Z-L, Chang R-F (2006) Security-constrained optimal power flow by mixed-integer genetic algorithm with arithmetic operators. In: 2006 IEEE power engineering society general meeting. IEEE, p 8

[Google Scholar](#)

15. Lai LL, Ma JT, Yokoyama R, Zhao M (1997) Improved genetic algorithms for optimal power flow under both normal and contingent operation states. *Int J Electr Power Energy Syst* 19(5):287–292

[Google Scholar](#)

16. Roa-Sepulveda CA, Pavez-Lazo BJ (2003) A solution to the optimal power flow using simulated annealing. *Int J Electri Power Energy Syst* 25(1):47–57

[Article](#) [Google Scholar](#)

17. Abido MA (2002) Optimal power flow using Tabu search algorithm. *Electr Power Comp Syst* 30(5):469–483

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18. Swain AK, Morris AS (2000) A novel hybrid evolutionary programming method for function optimization. In: *Proceedings of the 2000 congress on evolutionary computation*. CEC00 (Cat. No. 00TH8512), vol 1. IEEE, pp 699–705

[Google Scholar](#)

19. Cai J, Ma X, Li L, Yang Y, Peng H, Wang X (2007) Chaotic ant swarm optimization to economic dispatch. *Electr Power Syst Res* 77(10):1373–1380

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20. Tripathy M, Mishra S (2007) Bacteria foraging-based solution to optimize both real power loss and voltage stability limit. *IEEE Trans Power Syst* 22(1):240–248



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21. Abou El Ela AA, Abido MA, Spea SR (2010) Optimal power flow using differential evolution algorithm. *Electr Power Syst Res* 80(7):878–885

[Article](#) [Google Scholar](#)

22. Sivasubramani S, Swarup KS (2012) Multiagent based differential evolution approach to optimal power flow. *Appl Soft Comput* 12(2):735–740

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23. Roy PK, Ghoshal SP, Thakur SS (2010) Biogeography based optimization for multi-constraint optimal power flow with emission and non-smooth cost function. *Exp Syst Appl* 37(12):8221–8228

[Article](#) [Google Scholar](#)

24. Khazali AH, Kalantar M (2011) Optimal reactive power dispatch based on harmony search algorithm. *Int J Electr Power Energy Syst* 33(3):684–692

[Article](#) [Google Scholar](#)

25. Ayan K, Kılıç U (2012) Artificial bee colony algorithm solution for optimal reactive power flow. *Appl Soft Comput* 12(5):1477–1482

[Article](#) [Google Scholar](#)

26. Roy PK, Mandal B, Bhattacharya K (2012) Gravitational search algorithm based optimal reactive power dispatch for voltage stability enhancement. *Electr Power Syst Res* 40(9):956–976

[Article](#) [Google Scholar](#)

27. Basu M (2011) Multi-objective optimal power flow with facts devices. *Energy Conv Manag* 52(2):903–910

[Article](#) [Google Scholar](#)

28. Nobahari H, Nikusokhan M, Siarry P (2012) A multi-objective gravitational search algorithm based on non-dominated sorting. *Int J Swarm Intell Res (IJSIR)* 3(3):32–49

[Article](#) [Google Scholar](#)

29. Abido MA, Bakhashwain JM (2005) Optimal VAR dispatch using a multiobjective evolutionary algorithm. *Int J Electr Power Energy Syst* 27(1):13–20

[Article](#) [Google Scholar](#)

30. Gan D, Thomas RJ, Zimmerman RD (2000) Stability-constrained optimal power flow. *IEEE Trans Power Syst* 15(2):535–540

[Google Scholar](#)

31. Yuan Y, Kubokawa J, Sasaki H (2003) A solution of optimal power flow with multicontingency transient stability constraints. *IEEE Trans Power Syst* 18(3):1094–1102

[Article](#) [Google Scholar](#)

32. Chen L, Taka Y, Okamoto H, Tanabe R, Ono A (2001) Optimal operation solutions of power systems with transient stability constraints. *IEEE Transa Circ Syst I: Fundamental Theory Appl* 48(3):327–339

[Google Scholar](#)

33. Karaboga D et al (2005) An idea based on honey bee swarm for numerical optimization. Technical report, Technical report-tr06, Erciyes University, Engineering Faculty, Computer...,

[Google Scholar](#)

34. Chan KY, Chan KW, Ling SH, Iu HHC, Pong GTY (2007) Solving multi-contingency transient stability constrained optimal power flow problems with an improved GA. In: 2007 IEEE Congress on Evolutionary Computation. IEEE, pp 2901–2908

[Google Scholar](#)

35. Cai HR, Chung CY, Wong KP (2008) Application of differential evolution algorithm for transient stability constrained optimal power flow. IEEE Trans Power Syst 23(2):719–728

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36. Athay T, Podmore R, Virmani S (1979) A practical method for the direct analysis of transient stability. IEEE Trans Power Apparatus Syst (2):573–584

[Google Scholar](#)

37. Civicioglu P (2012) Transforming geocentric cartesian coordinates to geodetic coordinates by using differential search algorithm. Comput Geosci 46:229–247

[Article](#) [Google Scholar](#)

38. Tizhoosh HR (2005) Opposition-based learning: a new scheme for machine intelligence. In: International conference on computational intelligence for modelling,

control and automation and international conference on intelligent agents, web technologies and internet commerce (CIMCA-IAWTIC'06), vol 1. IEEE, pp 695–701

[Google Scholar](#)

39. Nguyen TB, Pai MA (2003) Dynamic security-constrained rescheduling of power systems using trajectory sensitivities. *IEEE Trans Power Syst* 18(2):848–854

[Google Scholar](#)

40. Vickers NJ (2017) Animal communication: when I'm calling you, will you answer too? *Curr Biol* 27(14):R713–R715

[Google Scholar](#)

41. Bhattacharya A, Chattopadhyay PK (2011) Application of biogeography-based optimisation to solve different optimal power flow problems. *IET Gen Trans Distrib* 5(1):70–80

[Article](#) [Google Scholar](#)

42. Duman S, Güvenç U, Sönmez Y, Yörükeren N (2012) Optimal power flow using gravitational search algorithm. *Energy Conv Manag* 59:86–95

[Article](#) [Google Scholar](#)

43. Mukherjee A, Paul S, Roy PK (2014) Transient stability constrained optimal power flow using teaching learning-based optimization. *Int J Energy Optim Eng (IJE OE)* 3(4):55–71

[Google Scholar](#)

44. Kürşat Ayan and ULAŞ KILIÇ (2013) Solution of transient stability-constrained optimal power flow using artificial bee colony algorithm. Turk J Electr Eng Comput Sci 21(2):360–372

[Google Scholar](#)

45. Ahmadi H, Ghasemi H, Haddadi AM, Lesani H (2013) Two approaches to transient stability-constrained optimal power flow. Int J Electr Power Energy Syst 47:181–192

[Article](#) [Google Scholar](#)

46. Xiaoping T, Dessaint L-A, Nguyen-Duc H (2013) Transient stability constrained optimal power flow using independent dynamic simulation. IET Gen Trans Distrib 7(3):244–253

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