

[28] Roy R, Jadhav HT. (2015). Optimal power flow solution of power system incorporating stochastic wind power using Gbest guided artificial bee colony algorithm. *Electrical Power and Energy Systems* 64: 562–578.

[29] Mohamed AAA, Mohamed YS, El-Gaafary AAM, Hemeida AM. (2017). Optimal power flow using moth swarm algorithm. *Electric Power Systems Research* 142: 190–206.

[30] Ghasemi M, Ghavidel S, Ghanbarian M. (2015). Multi-objective optimal electric power planning in the power system using Gaussian bare-bones imperialist competitive algorithm. *Information Sciences*. 294: 286–304. <https://doi.org/10.1016/j.ins.2014.09.051>

[31] El-Fergany AA, Hasanien HM. (2015). Single and multi-objective optimal power flow using grey wolf optimizer and differential evolution algorithms. *Electric Power Components and Systems* 43: 1548–1559. <https://doi.org/10.1080/15325008.2015.1041625>

[32] Kessel P, Glavitsch H. (1986). Estimating the voltage stability of a power system. *IEEE Trans Power Deliv* 1: 346–54. <https://doi.org/10.1109/TPWRD.1986.4308013>

[33] Zimmerman RD, Murillo-Sánchez CE, Thomas RJ. Matpower <http://www.pserc.cornell.edu/matpower>

NOMENCLATURE

$J(x, u)$	Objective function.
$h(x, u)$	Set of equality constraints.
$g(x, u)$	Set of inequality constraints.
X	State variables' Vector.

U	Control variables' Vector.
PG	Active power bus generator.
VG	Voltage magnitude at i -th PV bus (generator bus).
T	Transformer tap setting.
QC	Shunt VAR compensation.
$PG1$	Generator active power at slack bus.
VL	Bus voltage of p -th load bus (PQ bus).
QG	Reactive power generation of all generator units.
SL	Transmission line loading (or line flow).
NL and nl	Number of load buses and the number of transmission lines.
NC, NT and NG	Number of VAR compensators, the number of regulating transformers and the number of generators respectively.
P_D and Q_D	Active and reactive load demands.
G_{ij}	Transfer conductance
B_{ij}	Susceptance between bus i and bus j , respectively.
$V_{L_p}^{\min}$ and $V_{L_p}^{\max}$	Lowest and upper load voltage of i th unit.
S_{l_q}	Apparent power flow of i th branch.
$S_{l_q}^{\max}$	Maximum apparent power flow limit of i th branch.