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Research article

A power generation accumulation-based adaptive chaotic differential evolution algorithm for wind turbines placement problems

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Supplementary

This document serves as a supplementary file for "Power Generation Accumulation-based Adaptive Chaotic Differential Evolution Algorithm for Wind Turbine Placement Problems." It contains detailed results of our experiments. Tables S.I–S.IV present the experimental outcomes for various algorithms applied to wind scenarios 1–4, with optimal results from each algorithm highlighted in bold for clarity. Figures S.I–S.III depict convergence plots, each comprising three line graphs representing convergence for wind scenarios 1, 3, and 4, respectively. Figures S.IV–S.VI consist of box-and-whisker plots illustrating the conversion efficiency of different algorithms across three distinct wind turbine scenarios.

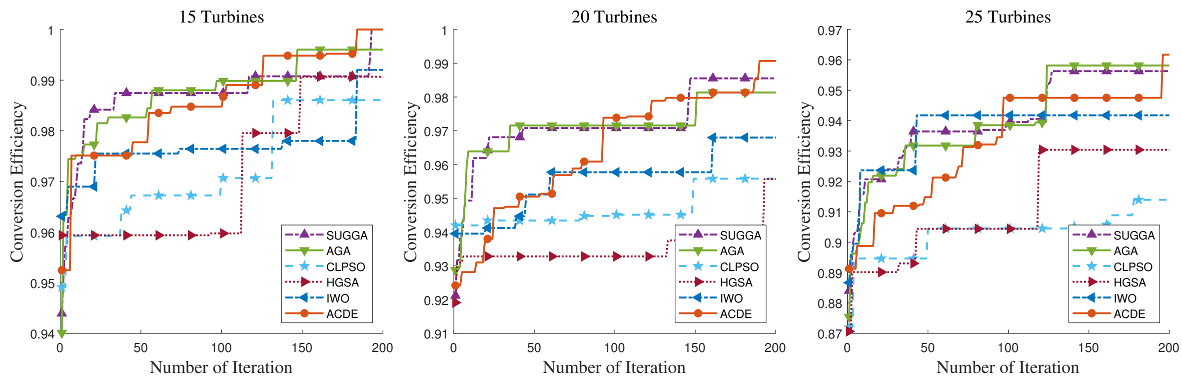

Figure S.I. The convergence plot on wind scenario 1.

Table S.I. The experimental results of all algorithms on wind scenario 1.

Turbine		AGA	SUGGA	CLPSO	HGSA	IWO	ACDE
	L0	99.51(0.23)	99.61(0.19)	98.12(0.56)	98.35(0.36)	98.81(0.32)	**99.71(0.17)**
	L1	99.31(0.27)	99.56(0.20)	97.67(0.46)	98.06(0.51)	98.63(0.38)	**99.70(0.19)**
	L2	99.54(0.18)	99.71(0.17)	98.51(0.21)	98.56(0.35)	98.99(0.26)	**99.78(0.16)**
	L3	98.99(0.29)	99.21(0.28)	97.47(0.41)	97.21(0.49)	98.27(0.39)	**99.33(0.26)**
	L4	99.42(0.22)	99.66(0.18)	98.14(0.31)	97.64(0.49)	98.75(0.33)	**99.73(0.18)**
	L5	99.40(0.17)	99.51(0.15)	98.56(0.31)	98.61(0.28)	98.71(0.26)	**99.69(0.15)**
15	L6	99.06(0.29)	99.49(0.32)	97.49(0.46)	97.11(0.72)	98.37(0.36)	**99.60(0.27)**
	L7	99.41(0.23)	99.56(0.20)	97.92(0.37)	97.99(0.44)	98.74(0.34)	**99.68(0.19)**
	L8	99.54(0.20)	99.64(0.18)	98.36(0.57)	98.40(0.33)	98.91(0.28)	**99.80(0.15)**
	L9	99.30(0.27)	99.46(0.20)	97.74(0.24)	97.54(0.42)	98.50(0.35)	**99.55(0.18)**
	L10	99.44(0.25)	99.60(0.18)	97.86(0.31)	97.65(0.49)	98.78(0.33)	**99.71(0.15)**
	L11	99.46(0.21)	99.61(0.18)	98.06(0.33)	98.41(0.45)	98.82(0.33)	**99.75(0.16)**
	L12	99.23(0.29)	99.39(0.22)	97.73(0.38)	97.58(0.48)	98.48(0.35)	**99.58(0.19)**
Average		99.35(0.24)	99.54(0.20)	97.97(0.38)	97.93(0.45)	98.67(0.33)	**99.66(0.18)**
p-value		1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	–
	L0	97.29(0.38)	97.74(0.29)	94.81(0.47)	95.06(0.60)	95.68(0.43)	**97.91(0.35)**
	L1	96.91(0.44)	97.29(0.37)	94.15(0.61)	94.35(0.61)	95.01(0.45)	**97.49(0.43)**
	L2	97.58(0.29)	97.85(0.28)	95.36(0.26)	95.60(0.51)	96.00(0.42)	**98.22(0.29)**
	L3	96.40(0.37)	96.93(0.37)	93.37(0.48)	93.71(0.58)	94.60(0.42)	**96.99(0.34)**
	L4	97.22(0.33)	97.68(0.42)	94.73(0.33)	94.40(0.60)	95.67(0.48)	**97.95(0.34)**
	L5	97.29(0.30)	97.74(0.26)	94.99(0.53)	95.86(0.53)	95.82(0.44)	**98.03(0.23)**
20	L6	96.51(0.48)	97.13(0.43)	93.50(0.46)	93.19(0.78)	94.70(0.36)	**97.25(0.37)**
	L7	97.10(0.34)	97.37(0.40)	94.35(0.45)	94.65(0.58)	95.35(0.36)	**97.67(0.36)**
	L8	97.46(0.29)	97.84(0.30)	95.00(0.39)	95.35(0.50)	95.88(0.39)	**98.04(0.33)**
	L9	96.94(0.41)	97.27(0.35)	94.11(0.40)	94.04(0.50)	95.20(0.42)	**97.51(0.30)**
	L10	97.30(0.35)	97.71(0.37)	94.55(0.44)	94.32(0.54)	95.73(0.39)	**97.94(0.41)**
	L11	97.22(0.33)	97.67(0.36)	94.88(0.50)	95.35(0.46)	95.76(0.40)	**97.94(0.24)**
	L12	96.65(0.43)	97.19(0.45)	93.80(0.55)	93.45(0.49)	95.01(0.37)	**97.34(0.38)**
Average		97.07(0.36)	97.49(0.36)	94.43(0.45)	94.56(0.56)	95.42(0.41)	**97.71(0.34)**
p-value		1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	–
	L0	94.81(0.34)	95.24(0.32)	91.29(0.45)	91.46(0.54)	92.38(0.47)	**95.54(0.34)**
	L1	94.20(0.48)	94.32(0.40)	90.73(0.71)	90.39(0.61)	91.27(0.38)	**94.58(0.37)**
	L2	95.17(0.30)	95.64(0.35)	92.77(0.84)	92.49(0.55)	92.88(0.34)	**96.08(0.34)**
	L3	93.62(0.33)	94.27(0.42)	90.32(0.50)	90.09(0.51)	90.79(0.50)	**94.34(0.35)**
	L4	94.65(0.30)	95.14(0.43)	91.51(0.36)	91.08(0.49)	92.19(0.46)	**95.39(0.37)**
	L5	94.93(0.35)	95.50(0.34)	92.70(0.62)	92.48(0.48)	92.65(0.49)	**95.99(0.36)**
25	L6	93.74(0.45)	94.45(0.55)	89.44(0.57)	89.05(0.58)	91.09(0.60)	**94.62(0.43)**
	L7	94.43(0.43)	94.68(0.39)	90.67(0.42)	91.24(0.80)	91.92(0.54)	**95.07(0.35)**
	L8	95.05(0.32)	95.51(0.35)	91.91(0.45)	92.08(0.79)	92.64(0.54)	**95.85(0.41)**
	L9	94.27(0.35)	94.80(0.34)	90.61(0.37)	90.65(0.69)	91.76(0.54)	**95.10(0.48)**
	L10	94.75(0.39)	95.34(0.51)	91.42(0.48)	91.02(0.56)	92.39(0.44)	**95.52(0.34)**
	L11	94.90(0.39)	95.47(0.33)	91.67(0.42)	92.23(0.53)	92.49(0.51)	**95.75(0.41)**
	L12	93.92(0.44)	**94.53(0.50)**	90.00(0.50)	89.82(0.64)	91.32(0.44)	94.43(0.33)
Average		94.49(0.37)	94.99(0.40)	91.16(0.51)	91.08(0.60)	91.98(0.48)	**95.25(0.37)**
p-value		1.22E-04	3.66E-04	1.22E-04	1.22E-04	1.22E-04	–

Table S.II. The experimental results of all algorithms on wind scenario 2.

Turbine		AGA	SUGGA	CLPSO	HGSA	IWO	ACDE
15	L0	98.18(0.26)	98.30(0.24)	96.35(0.47)	97.22(0.48)	96.39(0.36)	**98.41(0.23)**
	L1	97.84(0.26)	97.97(0.26)	95.90(0.50)	96.79(0.42)	95.86(0.37)	**98.10(0.30)**
	L2	98.01(0.21)	98.35(0.23)	97.00(0.41)	97.77(0.29)	96.33(0.34)	**98.50(0.24)**
	L3	97.96(0.30)	**98.02(0.37)**	95.75(0.34)	96.26(0.41)	95.73(0.38)	98.02(0.26)
	L4	98.18(0.28)	98.39(0.26)	96.61(0.31)	96.79(0.29)	96.64(0.34)	**98.55(0.21)**
	L5	98.07(0.23)	98.19(0.20)	97.30(0.63)	97.63(0.31)	96.39(0.34)	**98.48(0.24)**
	L6	97.46(0.31)	97.60(0.31)	95.61(0.22)	95.53(0.50)	95.36(0.31)	**97.78(0.30)**
	L7	97.87(0.26)	98.15(0.25)	96.25(0.33)	96.95(0.37)	96.18(0.44)	**98.26(0.25)**
	L8	98.04(0.29)	98.35(0.24)	96.99(0.35)	97.48(0.27)	96.45(0.36)	**98.52(0.21)**
	L9	97.95(0.35)	98.16(0.32)	96.44(0.37)	96.60(0.46)	95.94(0.28)	**98.24(0.20)**
	L10	98.20(0.23)	98.34(0.23)	96.55(0.29)	96.76(0.35)	96.57(0.39)	**98.45(0.18)**
	L11	98.07(0.24)	98.26(0.23)	96.50(0.32)	97.62(0.33)	96.45(0.34)	**98.44(0.22)**
	L12	97.83(0.37)	97.94(0.30)	95.79(0.30)	96.08(0.39)	95.98(0.39)	**98.11(0.30)**
Average		97.97(0.28)	98.16(0.27)	96.39(0.37)	96.88(0.38)	96.17(0.36)	**98.30(0.24)**
p-value		1.22E-04	2.44E-04	1.22E-04	1.22E-04	1.22E-04	–
20	L0	95.78(0.37)	95.80(0.28)	93.07(0.57)	94.18(0.39)	93.32(0.26)	**96.31(0.29)**
	L1	95.24(0.37)	95.27(0.41)	92.25(0.38)	93.64(0.38)	92.53(0.29)	**95.61(0.24)**
	L2	95.67(0.33)	95.85(0.33)	93.50(0.29)	94.68(0.38)	93.50(0.37)	**96.51(0.33)**
	L3	95.21(0.40)	95.21(0.39)	92.34(0.34)	92.70(0.40)	92.34(0.29)	**95.50(0.35)**
	L4	95.91(0.34)	95.94(0.26)	93.52(0.33)	93.85(0.35)	93.57(0.33)	**96.50(0.28)**
	L5	95.72(0.26)	95.84(0.29)	94.16(0.42)	94.66(0.40)	93.46(0.32)	**96.37(0.33)**
	L6	94.75(0.45)	94.66(0.44)	91.72(0.30)	91.88(0.42)	91.82(0.36)	**95.21(0.30)**
	L7	95.31(0.28)	95.48(0.37)	92.62(0.53)	93.87(0.36)	93.00(0.36)	**95.90(0.26)**
	L8	95.60(0.31)	95.78(0.28)	93.50(0.38)	94.72(0.38)	93.54(0.36)	**96.33(0.24)**
	L9	95.46(0.40)	95.47(0.39)	92.80(0.29)	93.43(0.43)	92.81(0.33)	**95.86(0.28)**
	L10	95.80(0.29)	95.78(0.28)	93.32(0.29)	93.91(0.36)	93.52(0.33)	**96.30(0.30)**
	L11	95.81(0.31)	95.86(0.33)	93.71(0.35)	94.65(0.36)	93.44(0.31)	**96.33(0.28)**
	L12	95.11(0.40)	95.05(0.36)	92.18(0.32)	92.75(0.40)	92.27(0.32)	**95.62(0.27)**
Average		95.49(0.35)	95.54(0.34)	92.98(0.37)	93.76(0.39)	93.01(0.33)	**96.03(0.29)**
p-value		1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	–
25	L0	93.16(0.33)	93.11(0.39)	89.96(0.38)	91.41(0.44)	90.31(0.26)	**93.84(0.27)**
	L1	92.33(0.39)	92.19(0.47)	89.01(0.36)	90.41(0.44)	89.20(0.42)	**92.80(0.30)**
	L2	93.00(0.29)	93.09(0.32)	90.63(0.32)	91.71(0.34)	90.52(0.54)	**94.02(0.28)**
	L3	92.26(0.38)	92.11(0.45)	88.80(0.38)	89.26(0.36)	89.01(0.32)	**92.72(0.29)**
	L4	93.37(0.34)	93.31(0.33)	90.26(0.39)	91.16(0.39)	90.63(0.35)	**94.07(0.32)**
	L5	93.34(0.26)	93.22(0.29)	90.91(0.38)	91.57(0.34)	90.58(0.29)	**94.09(0.25)**
	L6	91.97(0.43)	91.66(0.41)	88.21(0.27)	88.32(0.42)	88.37(0.38)	**92.43(0.29)**
	L7	92.65(0.35)	92.67(0.36)	89.95(0.62)	90.93(0.35)	89.82(0.31)	**93.37(0.32)**
	L8	93.02(0.32)	93.15(0.27)	90.64(0.41)	91.79(0.42)	90.35(0.30)	**94.00(0.29)**
	L9	92.57(0.45)	92.64(0.36)	89.39(0.40)	90.06(0.37)	89.77(0.40)	**93.30(0.24)**
	L10	93.20(0.30)	93.15(0.36)	90.24(0.35)	91.19(0.38)	90.61(0.38)	**93.95(0.26)**
	L11	93.12(0.28)	93.12(0.30)	90.57(0.27)	91.85(0.32)	90.46(0.37)	**93.96(0.30)**
	L12	92.07(0.44)	92.19(0.40)	88.79(0.36)	89.23(0.40)	89.07(0.42)	**92.88(0.30)**
Average		92.77(0.35)	92.74(0.36)	89.80(0.38)	90.68(0.38)	89.90(0.36)	**93.49(0.28)**
p-value		1.22E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	–

Table S.III. The experimental results of all algorithms on wind scenario 3.

Turbine		AGA	SUGGA	CLPSO	HGSA	IWO	ACDE
	L0	98.11(0.27)	98.64(0.18)	96.40(0.40)	96.96(0.36)	97.34(0.32)	**98.66(0.23)**
	L1	97.75(0.22)	98.02(0.23)	96.21(0.31)	96.68(0.57)	96.72(0.30)	**98.17(0.21)**
	L2	98.42(0.22)	98.73(0.17)	97.62(0.24)	97.34(0.32)	97.68(0.24)	**99.01(0.18)**
	L3	97.91(0.26)	**98.28(0.28)**	95.48(0.47)	95.52(0.45)	96.48(0.36)	98.22(0.30)
	L4	97.89(0.25)	98.19(0.23)	96.65(0.33)	96.10(0.36)	97.01(0.31)	**98.20(0.20)**
	L5	98.40(0.24)	98.80(0.18)	97.48(0.38)	97.62(0.25)	97.56(0.28)	**98.99(0.14)**
15	L6	97.63(0.24)	97.99(0.27)	95.85(0.41)	95.42(0.52)	96.61(0.31)	**98.02(0.23)**
	L7	98.01(0.25)	98.29(0.22)	96.30(0.38)	96.96(0.51)	97.11(0.33)	**98.37(0.24)**
	L8	98.21(0.19)	98.65(0.19)	97.12(0.38)	97.27(0.35)	97.51(0.29)	**98.78(0.20)**
	L9	97.92(0.26)	98.39(0.27)	96.33(0.33)	95.89(0.36)	96.90(0.31)	**98.46(0.24)**
	L10	98.02(0.25)	98.43(0.18)	96.80(0.33)	96.29(0.29)	97.31(0.31)	**98.52(0.26)**
	L11	98.22(0.20)	98.69(0.23)	97.12(0.35)	97.27(0.29)	97.40(0.26)	**98.80(0.19)**
	L12	97.70(0.23)	97.97(0.26)	96.21(0.30)	95.97(0.40)	96.82(0.30)	**98.06(0.24)**
Average		98.01(0.24)	98.39(0.22)	96.58(0.36)	96.56(0.39)	97.11(0.30)	**98.48(0.22)**
p-value		1.22E-04	8.54E-04	1.22E-04	1.22E-04	1.22E-04	–
	L0	96.03(0.40)	96.79(0.31)	93.60(0.40)	93.82(0.55)	94.35(0.40)	**96.97(0.38)**
	L1	95.32(0.25)	95.70(0.27)	92.47(0.55)	92.94(0.48)	93.37(0.33)	**96.07(0.35)**
	L2	96.44(0.30)	97.08(0.32)	94.62(0.36)	93.99(0.52)	94.71(0.39)	**97.47(0.24)**
	L3	95.46(0.44)	**96.21(0.50)**	92.44(0.56)	91.76(0.44)	92.83(0.38)	95.98(0.45)
	L4	95.58(0.28)	**96.14(0.41)**	92.98(0.37)	92.60(0.51)	93.82(0.31)	96.14(0.32)
	L5	96.40(0.30)	97.09(0.39)	94.71(0.41)	94.10(0.47)	94.52(0.38)	**97.45(0.23)**
20	L6	95.24(0.30)	**95.76(0.42)**	92.29(0.38)	91.14(0.64)	93.09(0.40)	95.66(0.28)
	L7	95.57(0.26)	96.23(0.30)	92.94(0.63)	93.29(0.40)	93.80(0.33)	**96.42(0.34)**
	L8	96.20(0.35)	96.87(0.27)	94.28(0.32)	93.94(0.40)	94.58(0.33)	**97.12(0.29)**
	L9	95.71(0.31)	96.31(0.37)	92.86(0.48)	92.49(0.45)	93.61(0.41)	**96.48(0.34)**
	L10	95.94(0.36)	96.45(0.39)	93.44(0.45)	93.10(0.50)	94.10(0.37)	**96.53(0.26)**
	L11	96.18(0.29)	97.02(0.51)	94.05(0.31)	93.94(0.44)	94.42(0.37)	**97.10(0.31)**
	L12	95.19(0.36)	95.60(0.36)	92.71(0.39)	92.26(0.54)	93.36(0.35)	**95.71(0.30)**
Average		95.79(0.32)	96.40(0.37)	93.34(0.43)	93.03(0.49)	93.89(0.36)	**96.55(0.31)**
p-value		1.22E-04	1.33E-02	1.22E-04	1.22E-04	1.22E-04	–
	L0	93.73(0.31)	**94.58(0.38)**	90.23(0.48)	90.44(0.58)	90.97(0.47)	94.55(0.38)
	L1	92.73(0.31)	93.26(0.31)	88.93(0.78)	89.24(0.61)	89.69(0.48)	**93.65(0.33)**
	L2	94.21(0.36)	94.98(0.35)	91.56(0.51)	90.61(0.59)	91.48(0.42)	**95.21(0.27)**
	L3	92.82(0.41)	**93.57(0.40)**	89.33(0.81)	87.99(0.56)	89.02(0.59)	93.42(0.41)
	L4	93.27(0.42)	**93.81(0.44)**	89.82(0.71)	89.05(0.52)	90.11(0.40)	93.64(0.30)
	L5	94.01(0.37)	94.86(0.41)	91.30(0.41)	90.45(0.62)	91.30(0.58)	**95.31(0.32)**
25	L6	92.68(0.44)	**93.29(0.50)**	88.87(0.60)	87.08(0.78)	89.38(0.47)	93.24(0.31)
	L7	93.22(0.41)	93.95(0.38)	89.84(0.56)	90.05(0.61)	90.35(0.39)	**94.17(0.36)**
	L8	93.96(0.37)	94.70(0.39)	91.20(0.62)	90.48(0.52)	91.33(0.39)	**95.10(0.36)**
	L9	93.29(0.44)	94.10(0.48)	89.77(0.41)	88.51(0.51)	90.05(0.43)	**94.19(0.37)**
	L10	93.56(0.40)	94.13(0.39)	90.29(0.58)	89.41(0.54)	90.87(0.53)	**94.27(0.45)**
	L11	93.86(0.33)	94.60(0.34)	90.77(0.57)	90.34(0.46)	91.19(0.41)	**94.96(0.38)**
	L12	92.44(0.39)	92.99(0.40)	88.98(0.39)	88.09(0.67)	89.75(0.49)	**93.01(0.43)**
Average		93.37(0.38)	94.06(0.40)	90.07(0.57)	89.37(0.58)	90.42(0.46)	**94.21(0.36)**
p-value		1.22E-04	2.87E-02	1.22E-04	1.22E-04	1.22E-04	–

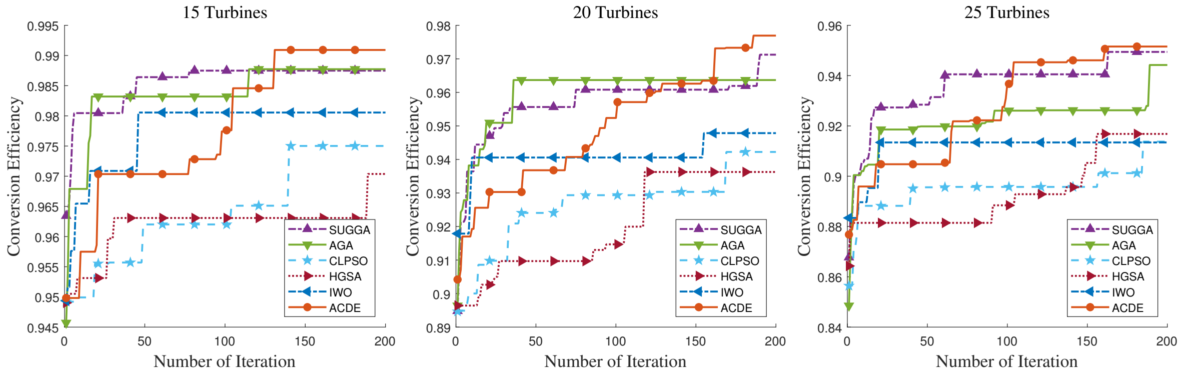

Figure S.II. The convergence plot on wind scenario 3.

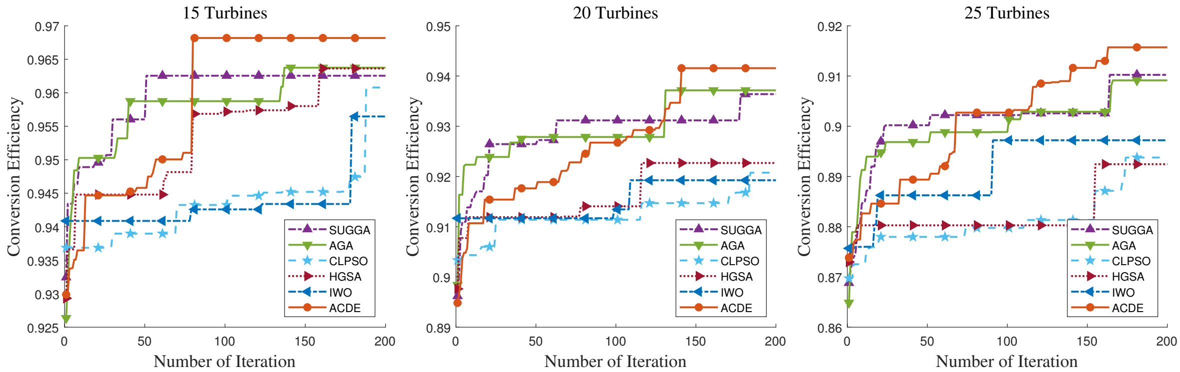

Figure S.III. The convergence plot on wind scenario 4.

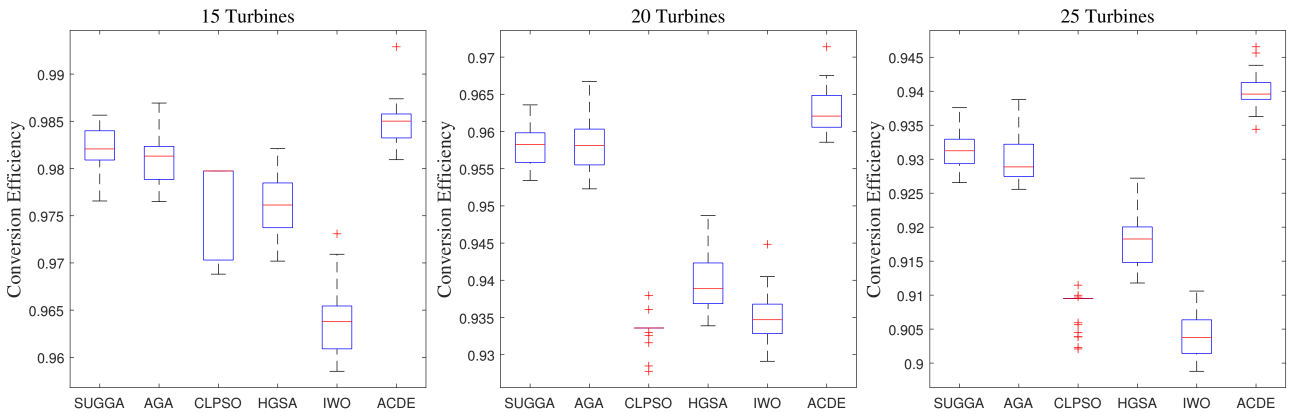

Figure S.IV. The box-and-whisker plot on wind scenario 2.

Table S.IV. The experimental results of all algorithms on wind scenario 4.

Turbine		AGA	SUGGA	CLPSO	HGSA	IWO	ACDE
	L0	95.96(0.20)	95.94(0.19)	94.60(0.43)	95.64(0.32)	94.56(0.27)	**96.33(0.20)**
	L1	**95.60(0.27)**	95.45(0.31)	94.14(0.43)	94.48(0.31)	93.64(0.22)	95.54(0.22)
	L2	96.04(0.21)	95.90(0.24)	95.00(0.23)	95.34(0.25)	94.56(0.20)	**96.29(0.21)**
	L3	**95.63(0.32)**	95.59(0.41)	93.81(0.27)	94.14(0.26)	93.60(0.25)	95.53(0.20)
	L4	95.98(0.21)	95.84(0.18)	94.75(0.17)	94.77(0.28)	94.59(0.23)	**96.29(0.21)**
	L5	96.11(0.22)	95.95(0.19)	95.07(0.24)	95.04(0.25)	94.67(0.25)	**96.42(0.30)**
15	L6	95.42(0.37)	95.29(0.39)	93.40(0.23)	93.05(0.34)	93.47(0.26)	**95.44(0.22)**
	L7	95.72(0.27)	95.65(0.27)	93.96(0.62)	95.12(0.41)	94.19(0.25)	**95.97(0.22)**
	L8	96.03(0.22)	95.94(0.19)	94.91(0.26)	95.35(0.23)	94.60(0.21)	**96.32(0.26)**
	L9	95.60(0.22)	95.66(0.27)	94.07(0.38)	94.75(0.25)	94.19(0.24)	**95.93(0.22)**
	L10	95.98(0.17)	95.94(0.18)	94.62(0.35)	95.01(0.22)	94.58(0.20)	**96.35(0.24)**
	L11	96.03(0.22)	95.96(0.19)	95.17(0.36)	95.48(0.17)	94.62(0.21)	**96.34(0.22)**
	L12	95.55(0.27)	95.62(0.35)	94.11(0.30)	94.04(0.27)	93.88(0.27)	**95.85(0.22)**
Average		95.82(0.24)	95.75(0.26)	94.43(0.33)	94.79(0.27)	94.24(0.23)	**96.05(0.23)**
p-value		1.22E-03	2.44E-04	1.22E-04	1.22E-04	1.22E-04	–
	L0	93.12(0.19)	93.09(0.22)	91.55(0.32)	92.08(0.30)	91.44(0.24)	**93.68(0.19)**
	L1	**92.48(0.31)**	92.40(0.38)	90.38(0.27)	90.81(0.27)	90.19(0.20)	92.47(0.22)
	L2	93.12(0.25)	93.04(0.22)	91.43(0.25)	91.80(0.24)	91.46(0.20)	**93.59(0.25)**
	L3	92.46(0.32)	92.35(0.38)	90.05(0.30)	90.40(0.22)	90.13(0.25)	**92.50(0.25)**
	L4	93.20(0.18)	93.00(0.21)	91.66(0.35)	91.66(0.27)	91.41(0.20)	**93.61(0.19)**
	L5	93.33(0.24)	93.10(0.21)	91.58(0.20)	91.60(0.25)	91.69(0.32)	**93.74(0.23)**
20	L6	92.11(0.40)	92.04(0.47)	89.30(0.46)	89.33(0.36)	89.83(0.23)	**92.15(0.20)**
	L7	92.77(0.28)	92.67(0.28)	91.07(0.33)	91.50(0.33)	90.88(0.22)	**93.22(0.29)**
	L8	93.20(0.25)	93.10(0.21)	91.56(0.24)	92.15(0.25)	91.44(0.23)	**93.64(0.21)**
	L9	92.55(0.31)	92.58(0.28)	90.68(0.36)	91.11(0.26)	90.86(0.25)	**93.07(0.26)**
	L10	93.14(0.23)	93.13(0.22)	91.65(0.25)	91.81(0.26)	91.50(0.25)	**93.75(0.27)**
	L11	93.18(0.24)	93.12(0.22)	91.67(0.24)	92.03(0.21)	91.59(0.26)	**93.76(0.20)**
	L12	92.45(0.25)	92.32(0.31)	90.63(0.44)	90.32(0.30)	90.48(0.21)	**92.90(0.23)**
Average		92.85(0.27)	92.76(0.28)	91.02(0.31)	91.28(0.27)	90.99(0.23)	**93.24(0.23)**
p-value		2.44E-04	1.22E-04	1.22E-04	1.22E-04	1.22E-04	–
	L0	90.29(0.17)	90.30(0.24)	88.07(0.41)	89.05(0.29)	88.36(0.19)	**90.96(0.19)**
	L1	**89.54(0.41)**	89.28(0.40)	86.85(0.35)	87.33(0.24)	86.79(0.24)	89.37(0.19)
	L2	90.20(0.19)	90.13(0.24)	88.49(0.21)	88.41(0.29)	88.38(0.24)	**90.72(0.20)**
	L3	89.35(0.34)	89.20(0.47)	86.73(0.25)	86.86(0.25)	86.67(0.26)	**89.44(0.20)**
	L4	90.36(0.17)	90.25(0.23)	88.49(0.21)	88.60(0.29)	88.37(0.20)	**90.88(0.16)**
	L5	90.48(0.21)	90.33(0.20)	88.73(0.20)	88.56(0.28)	88.71(0.26)	**91.00(0.20)**
25	L6	**89.04(0.43)**	88.82(0.47)	85.99(0.26)	85.64(0.41)	86.40(0.23)	88.86(0.23)
	L7	89.90(0.23)	89.81(0.31)	87.69(0.33)	88.29(0.30)	87.66(0.23)	**90.23(0.19)**
	L8	90.33(0.17)	90.29(0.20)	88.15(0.42)	88.75(0.29)	88.41(0.18)	**90.94(0.17)**
	L9	89.52(0.25)	89.59(0.23)	87.27(0.33)	87.83(0.27)	87.65(0.27)	**90.20(0.20)**
	L10	90.40(0.17)	90.34(0.23)	88.39(0.26)	88.75(0.28)	88.41(0.25)	**90.98(0.19)**
	L11	90.38(0.18)	90.28(0.21)	88.60(0.16)	88.73(0.20)	88.49(0.22)	**90.96(0.19)**
	L12	89.34(0.33)	89.38(0.36)	86.95(0.33)	86.94(0.31)	87.14(0.25)	**89.77(0.22)**
Average		89.93(0.25)	89.85(0.29)	87.72(0.29)	87.98(0.29)	87.80(0.23)	**90.33(0.19)**
p-value		1.22E-03	1.22E-04	1.22E-04	1.22E-04	1.22E-04	–

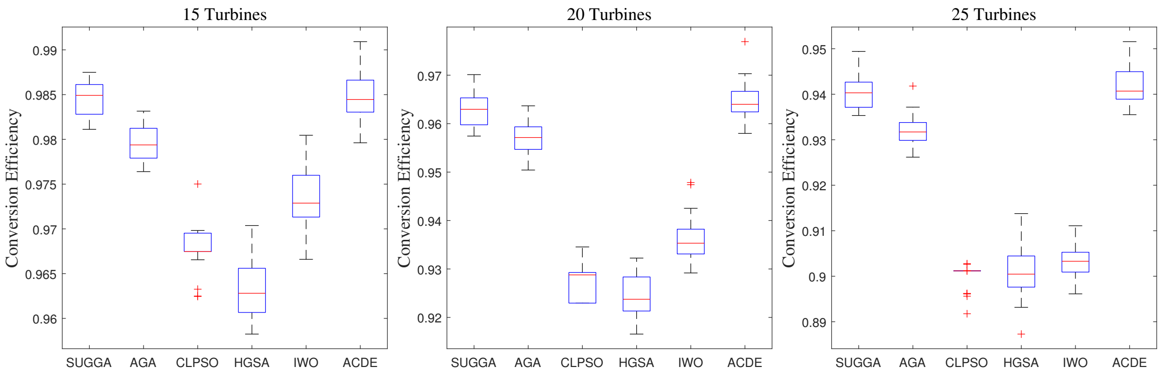

Figure S.V. The box-and-whisker plot on wind scenario 3.

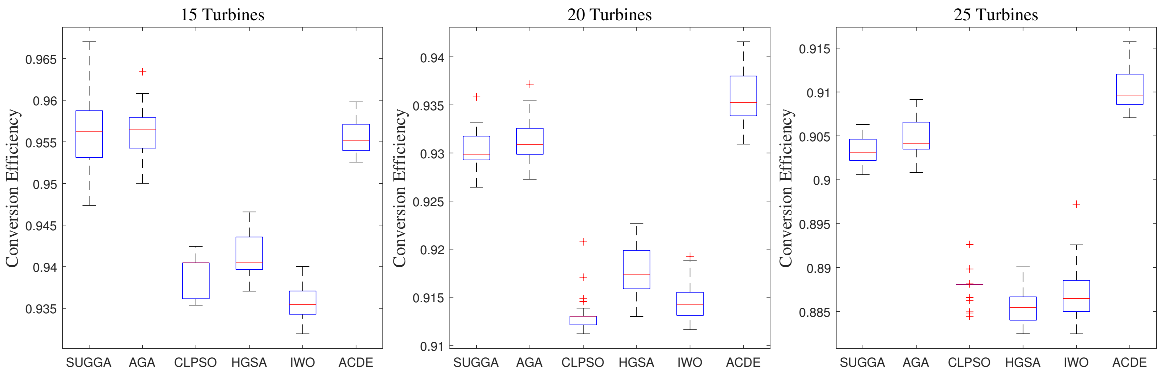

Figure S.VI. The box-and-whisker plot on wind scenario 4.

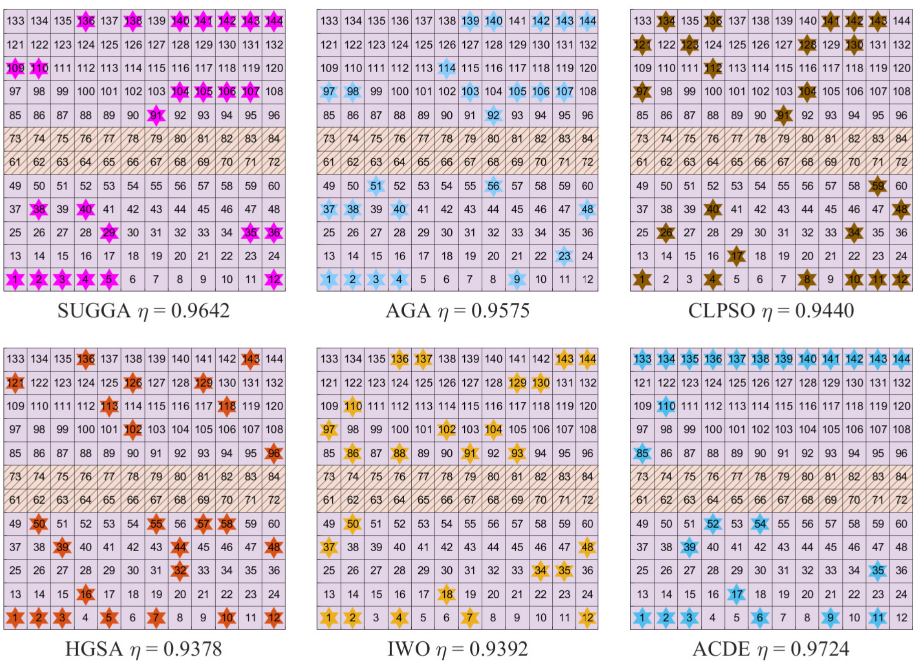

Figure S.VII. The wind farm layout plot under wind scenario 1.

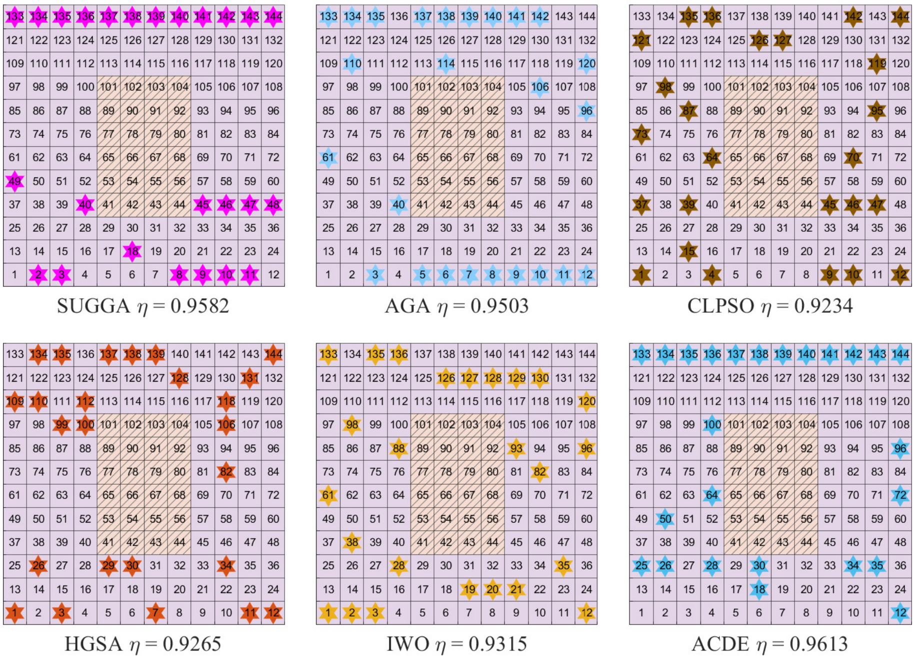

Figure S.VIII. The wind farm layout plot under wind scenario 3.

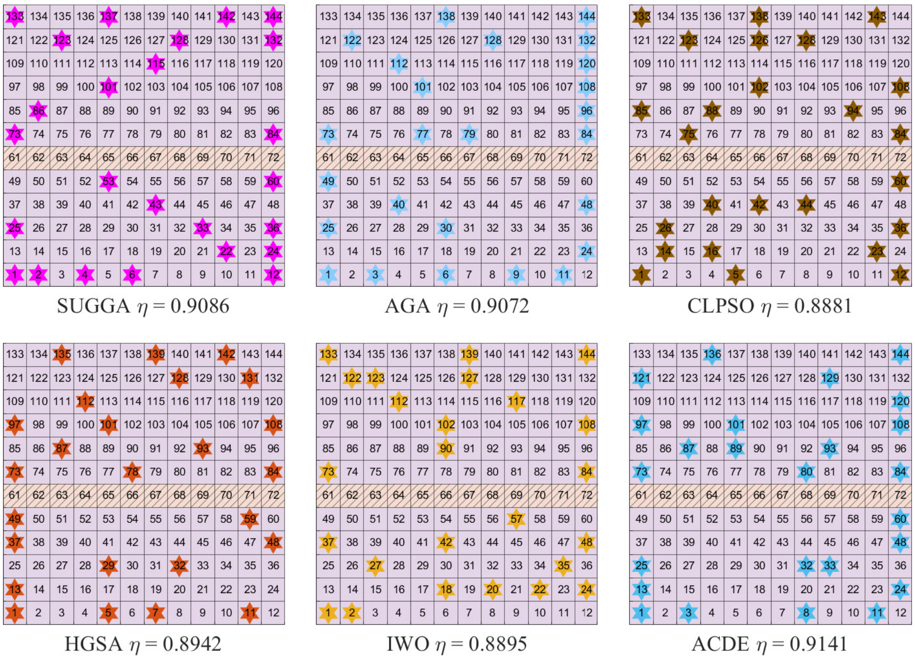

Figure S.IX. The wind farm layout plot under wind scenario 4.

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