Table 1: The comparison results of MTEA-ATS with other six algorithms on CEC19-MaTSO1 problem

	MTEA-ATS	KR-MTEA	BoKTDE	MTEA-SaO	AEMTO	MaTDE	DE
CEC19-MaTSO1-T1	5.57e+01	1.15e+02 -	7.35e+01 -	7.85e+01 -	1.19e+02 -	1.56e+02 -	8.26e+02 -
CEC19-MaTSO1-T2	5.91e+01	5.28e+01 =	9.90e+01 -	6.31e+01 =	1.27e+02 -	1.63e+02 -	9.21e+02 -
CEC19-MaTSO1-T3	5.54e+01	1.69e+02 -	8.70e+01 -	6.64e+01 -	3.02e+02 -	1.97e+02 -	9.42e+02 -
CEC19-MaTSO1-T4	4.94e+01	4.68e+01 =	8.57e+01 -	7.59e+01 -	1.76e+02 -	2.07e+02 -	1.01e+03 -
CEC19-MaTSO1-T5	5.51e+01	1.28e+02 -	9.07e+01 -	7.13e+01 -	1.43e+02 -	1.56e+02 -	8.63e+02 -
CEC19-MaTSO1-T6	5.24e+01	4.68e+01 =	6.07e+01 -	6.00e+01 -	1.25e+02 -	2.22e+02 -	1.07e+03 -
CEC19-MaTSO1-T7	5.24e+01	1.48e+02 -	6.41e+01 -	6.95e+01 -	1.45e+02 -	1.22e+02 -	9.71e+02 -
CEC19-MaTSO1-T8	4.68e+01	5.27e+01 =	8.05e+01 -	5.82e+01 -	2.59e+02 -	2.86e+02 -	9.28e+02 -
CEC19-MaTSO1-T9	5.25e+01	1.28e+02 -	8.33e+01 -	6.79e+01 -	1.44e+02 -	2.08e+02 -	9.03e+02 -
CEC19-MaTSO1-T10	4.69e+01	4.70e+01 =	4.83e+01 -	5.87e+01 -	2.00e+02 -	1.79e+02 -	8.82e+02 -
CEC19-MaTSO1-T11	4.69e+01	9.74e+01 -	5.19e+01 -	6.08e+01 -	1.80e+02 -	1.46e+02 -	9.28e+02 -
CEC19-MaTSO1-T12	4.69e+01	4.68e+01 =	6.24e+01 -	6.81e+01 -	1.36e+02 -	1.93e+02 -	9.13e+02 -
CEC19-MaTSO1-T13	4.68e+01	8.93e+01 -	5.61e+01 -	5.82e+01 -	8.53e+02 -	1.22e+02 -	1.10e+03 -
CEC19-MaTSO1-T14	4.65e+01	4.70e+01 -	8.15e+01 -	7.49e+01 -	1.49e+02 -	1.86e+02 -	9.84e+02 -
CEC19-MaTSO1-T15	4.68e+01	9.03e+01 -	5.94e+01 -	8.01e+01 -	1.97e+02 -	2.03e+02 -	1.06e+03 -
CEC19-MaTSO1-T16	5.98e+01	5.26e+01 =	6.50e+01 -	7.45e+01 -	1.50e+02 -	2.01e+02 -	1.05e+03 -
CEC19-MaTSO1-T17	6.14e+01	1.50e+02 -	9.67e+01 -	7.41e+01 -	1.33e+02 -	2.31e+02 -	1.00e+03 -
CEC19-MaTSO1-T18	5.25e+01	4.68e+01 =	9.71e+01 -	8.09e+01 -	1.46e+02 -	1.65e+02 -	9.97e+02 -
CEC19-MaTSO1-T19	5.56e+01	1.75e+02 -	5.46e+01 +	6.85e+01 -	1.70e+02 -	1.80e+02 -	9.96e+02 -
CEC19-MaTSO1-T20	4.98e+01	4.68e+01 =	8.25e+01 -	7.69e+01 -	1.54e+02 -	1.88e+02 -	9.18e+02 -
CEC19-MaTSO1-T21	4.97e+01	1.67e+02 -	7.93e+01 -	6.44e+01 -	2.33e+02 -	2.43e+02 -	1.03e+03 -
CEC19-MaTSO1-T22	7.38e+01	6.35e+01 =	8.38e+01 -	7.26e+01 =	2.34e+02 -	2.02e+02 -	1.07e+03 -
CEC19-MaTSO1-T23	4.69e+01	1.15e+02 -	6.58e+01 -	7.71e+01 -	2.87e+02 -	2.16e+02 -	9.46e+02 -
CEC19-MaTSO1-T24	4.65e+01	4.69e+01 -	1.49e+02 -	6.90e+01 -	1.56e+02 -	1.37e+02 -	9.46e+02 -
CEC19-MaTSO1-T25	4.66e+01	1.07e+02 -	1.38e+02 -	5.17e+01 -	4.98e+02 -	2.01e+02 -	9.20e+02 -
CEC19-MaTSO1-T26	4.69e+01	4.68e+01 =	5.56e+01 -	7.99e+01 -	1.48e+02 -	1.88e+02 -	8.73e+02 -
CEC19-MaTSO1-T27	4.97e+01	1.39e+02 -	5.23e+01 -	5.56e+01 -	1.58e+02 -	1.58e+02 -	8.69e+02 -
CEC19-MaTSO1-T28	4.95e+01	4.68e+01 =	4.83e+01 +	5.85e+01 -	1.23e+02 -	1.63e+02 -	8.49e+02 -
CEC19-MaTSO1-T29	6.99e+01	2.38e+02 -	7.76e+01 =	7.32e+01 =	1.58e+02 -	2.71e+02 -	9.34e+02 -
CEC19-MaTSO1-T30	4.67e+01	5.30e+01 -	1.02e+02 -	7.11e+01 -	2.31e+02 -	2.90e+02 -	9.62e+02 -
CEC19-MaTSO1-T31	4.68e+01	1.15e+02 -	7.46e+01 -	7.73e+01 -	1.75e+02 -	1.48e+02 -	8.44e+02 -
CEC19-MaTSO1-T32	5.55e+01	5.00e+01 =	8.09e+01 -	7.92e+01 -	1.69e+02 -	2.23e+02 -	9.92e+02 -
CEC19-MaTSO1-T33	4.69e+01	8.54e+01 -	1.22e+02 -	6.37e+01 -	2.27e+02 -	1.58e+02 -	1.01e+03 -
CEC19-MaTSO1-T34	4.97e+01	4.69e+01 =	5.96e+01 -	5.67e+01 -	2.30e+02 -	1.90e+02 -	9.85e+02 -
CEC19-MaTSO1-T35	5.25e+01	1.40e+02 -	7.94e+01 -	5.74e+01 =	1.37e+02 -	1.93e+02 -	9.46e+02 -
CEC19-MaTSO1-T36	7.29e+01	9.57e+01 -	1.14e+02 -	7.51e+01 =	1.80e+02 -	2.65e+02 -	9.54e+02 -
CEC19-MaTSO1-T37	5.54e+01	1.28e+02 -	1.14e+02 -	9.40e+01 -	1.16e+02 -	2.45e+02 -	9.38e+02 -
CEC19-MaTSO1-T38	5.86e+01	7.03e+01 -	7.86e+01 -	7.09e+01 -	1.60e+02 -	2.09e+02 -	9.09e+02 -
CEC19-MaTSO1-T39	4.95e+01	1.32e+02 -	1.33e+02 -	6.28e+01 -	1.77e+02 -	1.60e+02 -	9.76e+02 -
CEC19-MaTSO1-T40	5.34e+01	4.68e+01 -	6.95e+01 -	6.60e+01 -	2.46e+02 -	2.07e+02 -	9.79e+02 -
CEC19-MaTSO1-T41	5.25e+01	1.32e+02 -	7.84e+01 -	6.53e+01 =	1.63e+02 -	2.03e+02 -	9.55e+02 -
CEC19-MaTSO1-T42	5.23e+01	4.68e+01 -	1.05e+02 -	5.97e+01 -	1.26e+02 -	1.39e+02 -	8.24e+02 -
CEC19-MaTSO1-T43	4.70e+01	1.18e+02 -	8.24e+01 -	6.15e+01 -	1.90e+02 -	1.63e+02 -	1.03e+03 -
CEC19-MaTSO1-T44	5.82e+01	5.29e+01 =	9.40e+01 -	6.20e+01 -	1.26e+02 -	2.23e+02 -	9.05e+02 -
CEC19-MaTSO1-T45	4.69e+01	1.28e+02 -	1.36e+02 -	5.61e+01 -	1.89e+02 -	1.72e+02 -	9.66e+02 -
CEC19-MaTSO1-T46	5.26e+01	6.08e+01 -	7.00e+01 -	6.36e+01 -	1.47e+02 -	2.20e+02 -	9.32e+02 -
CEC19-MaTSO1-T47	5.27e+01	1.51e+02 -	8.43e+01 -	8.00e+01 -	2.00e+02 -	2.33e+02 -	9.08e+02 -
CEC19-MaTSO1-T48	5.55e+01	6.29e+01 =	1.04e+02 -	6.73e+01 -	1.60e+02 -	2.13e+02 -	8.35e+02 -
CEC19-MaTSO1-T49	4.89e+01	1.30e+02 -	5.07e+01 -	6.14e+01 -	1.34e+02 -	1.85e+02 -	9.08e+02 -
CEC19-MaTSO1-T50	4.97e+01	5.57e+01 -	7.14e+01 -	6.02e+01 -	1.22e+02 -	2.00e+02 -	8.18e+02 -
+/-/=	Base	0/31/19	2/47/1	0/44/6	0/50/0	0/50/0	0/50/0

Table 2: The comparison results of MTEA-ATS with other six algorithms on CEC19-MaTSO2 problem

	MTEA-ATS	KR-MTEA	BoKTDE	MTEA-SaO	AEMTO	MaTDE	DE
CEC19-MaTSO2-T1	1.08e-08	1.33e-03 -	2.03e+01 -	8.65e-03 -	1.17e-01 -	3.10e-05 -	2.02e+01 -
CEC19-MaTSO2-T2	1.15e-09	1.70e-07 -	2.02e+01 -	8.82e-03 -	1.16e-01 -	2.60e-05 -	2.02e+01 -
CEC19-MaTSO2-T3	2.44e-08	1.56e-03 -	2.02e+01 -	8.23e-03 -	1.24e-01 -	2.76e-05 -	2.02e+01 -
CEC19-MaTSO2-T4	3.83e-08	3.47e-07 -	2.03e+01 -	8.27e-03 -	1.18e-01 =	3.36e-05 -	2.02e+01 -
CEC19-MaTSO2-T5	3.20e-08	1.65e-03 -	2.03e+01 -	9.29e-03 -	1.23e-01 =	3.34e-05 -	2.02e+01 -
CEC19-MaTSO2-T6	0.00e+00	4.09e-08 -	2.02e+01 -	8.22e-03 -	1.19e-01 -	3.11e-05 -	2.01e+01 -
CEC19-MaTSO2-T7	1.72e-08	1.41e-03 -	2.02e+01 -	8.48e-03 -	1.25e-01 -	3.24e-05 -	2.02e+01 -
CEC19-MaTSO2-T8	4.94e-09	1.15e-06 -	2.02e+01 -	8.76e-03 -	1.19e-01 -	2.99e-05 -	2.02e+01 -
CEC19-MaTSO2-T9	0.00e+00	1.41e-03 -	2.03e+01 -	8.12e-03 -	1.21e-01 -	2.68e-05 -	2.02e+01 -
CEC19-MaTSO2-T10	2.49e-08	2.96e-07 -	2.03e+01 -	8.38e-03 -	1.18e-01 -	2.73e-05 -	2.02e+01 -
CEC19-MaTSO2-T11	7.06e-09	1.60e-03 -	2.03e+01 -	8.40e-03 -	1.25e-01 -	3.02e-05 -	2.02e+01 -
CEC19-MaTSO2-T12	6.03e-09	4.32e-07 -	2.02e+01 -	9.17e-03 -	1.13e-01 -	2.44e-05 -	2.02e+01 -
CEC19-MaTSO2-T13	2.39e-09	1.46e-03 -	2.02e+01 -	9.12e-03 -	1.18e-01 -	2.82e-05 -	2.02e+01 -
CEC19-MaTSO2-T14	1.08e-07	1.28e-07 =	2.02e+01 -	7.95e-03 -	1.18e-01 -	3.23e-05 -	2.02e+01 -
CEC19-MaTSO2-T15	2.59e-08	1.60e-03 -	2.03e+01 -	8.67e-03 -	1.28e-01 -	3.63e-05 -	2.02e+01 -
CEC19-MaTSO2-T16	1.75e-08	7.71e-08 -	2.02e+01 -	8.79e-03 -	1.22e-01 -	3.29e-05 -	2.02e+01 -
CEC19-MaTSO2-T17	1.21e-08	1.70e-03 -	2.03e+01 -	9.11e-03 -	1.20e-01 -	3.15e-05 -	2.02e+01 -
CEC19-MaTSO2-T18	6.65e-09	6.95e-08 -	2.03e+01 -	8.88e-03 -	1.21e-01 -	2.70e-05 -	2.02e+01 -
CEC19-MaTSO2-T19	1.21e-09	1.40e-03 -	2.02e+01 -	8.13e-03 -	1.12e-01 -	2.85e-05 -	2.02e+01 -
CEC19-MaTSO2-T20	5.57e-08	1.24e-07 =	2.03e+01 -	8.36e-03 -	1.24e-01 -	2.91e-05 -	2.02e+01 -
CEC19-MaTSO2-T21	1.10e-08	1.55e-03 -	2.03e+01 -	7.98e-03 -	1.19e-01 =	3.02e-05 -	2.02e+01 -
CEC19-MaTSO2-T22	5.21e-08	9.53e-08 -	2.02e+01 -	8.85e-03 -	1.14e-01 -	2.82e-05 -	2.02e+01 -
CEC19-MaTSO2-T23	0.00e+00	1.29e-03 -	2.03e+01 -	7.76e-03 -	1.16e-01 -	2.81e-05 -	2.02e+01 -
CEC19-MaTSO2-T24	3.04e-09	2.15e-07 -	2.02e+01 -	8.75e-03 -	1.21e-01 -	3.21e-05 -	2.02e+01 -
CEC19-MaTSO2-T25	1.39e-08	1.55e-03 -	2.03e+01 -	9.21e-03 -	1.25e-01 -	3.25e-05 -	2.02e+01 -
CEC19-MaTSO2-T26	2.09e-09	2.66e-07 -	2.02e+01 -	8.79e-03 -	1.17e-01 -	2.76e-05 -	2.02e+01 -
CEC19-MaTSO2-T27	1.23e-08	1.52e-03 -	2.03e+01 -	9.68e-03 -	1.23e-01 -	3.30e-05 -	2.02e+01 -
CEC19-MaTSO2-T28	9.65e-10	9.81e-08 -	2.03e+01 -	8.90e-03 -	1.20e-01 -	3.07e-05 -	2.03e+01 -
CEC19-MaTSO2-T29	0.00e+00	1.30e-03 -	2.03e+01 -	8.34e-03 -	1.27e-01 -	3.11e-05 -	2.02e+01 -
CEC19-MaTSO2-T30	5.99e-08	1.90e-07 =	2.02e+01 -	8.98e-03 -	1.15e-01 =	3.09e-05 -	2.02e+01 -
CEC19-MaTSO2-T31	7.95e-10	1.73e-03 -	2.03e+01 -	8.49e-03 -	1.22e-01 -	2.64e-05 -	2.02e+01 -
CEC19-MaTSO2-T32	1.36e-08	1.13e-07 =	2.02e+01 -	8.60e-03 -	1.18e-01 =	2.68e-05 -	2.02e+01 -
CEC19-MaTSO2-T33	2.83e-08	1.61e-03 -	2.02e+01 -	1.03e-02 -	1.18e-01 -	3.13e-05 -	2.02e+01 -
CEC19-MaTSO2-T34	8.71e-09	1.17e-07 -	2.02e+01 -	9.86e-03 -	1.19e-01 -	2.62e-05 -	2.02e+01 -
CEC19-MaTSO2-T35	8.07e-10	1.59e-03 -	2.03e+01 -	7.82e-03 -	1.30e-01 -	2.88e-05 -	2.02e+01 -
CEC19-MaTSO2-T36	2.17e-08	3.90e-07 -	2.03e+01 -	8.75e-03 -	1.17e-01 -	3.13e-05 -	2.03e+01 -
CEC19-MaTSO2-T37	8.15e-08	1.59e-03 -	2.03e+01 -	8.12e-03 -	1.19e-01 =	3.17e-05 -	2.02e+01 -
CEC19-MaTSO2-T38	3.21e-08	3.29e-07 -	2.03e+01 -	9.35e-03 -	1.32e-01 -	2.83e-05 -	2.02e+01 -
CEC19-MaTSO2-T39	3.26e-09	1.40e-03 -	2.02e+01 -	8.70e-03 -	1.17e-01 -	2.78e-05 -	2.02e+01 -
CEC19-MaTSO2-T40	1.33e-08	5.73e-07 -	2.03e+01 -	8.47e-03 -	1.30e-01 =	3.28e-05 -	2.02e+01 -
CEC19-MaTSO2-T41	1.03e-08	1.53e-03 -	2.02e+01 -	7.75e-03 -	1.15e-01 -	2.79e-05 -	2.02e+01 -
CEC19-MaTSO2-T42	1.28e-07	2.67e-07 -	2.02e+01 -	8.38e-03 -	1.20e-01 -	2.81e-05 -	2.02e+01 -
CEC19-MaTSO2-T43	2.69e-08	1.63e-03 -	2.03e+01 -	8.36e-03 -	1.22e-01 -	3.08e-05 -	2.02e+01 -
CEC19-MaTSO2-T44	2.53e-08	1.29e-07 =	2.03e+01 -	8.43e-03 -	1.17e-01 -	3.40e-05 -	2.02e+01 -
CEC19-MaTSO2-T45	1.04e-08	1.48e-03 -	2.02e+01 -	8.78e-03 -	1.13e-01 -	2.93e-05 -	2.02e+01 -
CEC19-MaTSO2-T46	5.71e-08	2.65e-07 -	2.02e+01 -	7.97e-03 -	1.20e-01 =	3.05e-05 -	2.02e+01 -
CEC19-MaTSO2-T47	0.00e+00	1.48e-03 -	2.03e+01 -	9.25e-03 -	1.16e-01 -	2.98e-05 -	2.02e+01 -
CEC19-MaTSO2-T48	1.05e-09	2.72e-07 -	2.03e+01 -	8.75e-03 -	1.13e-01 -	3.12e-05 -	2.02e+01 -
CEC19-MaTSO2-T49	1.17e-07	1.70e-03 -	2.02e+01 -	9.27e-03 -	1.15e-01 =	2.86e-05 -	2.02e+01 -
CEC19-MaTSO2-T50	5.09e-08	1.07e-07 =	2.03e+01 -	8.37e-03 -	1.23e-01 =	3.05e-05 -	2.02e+01 -
+/-/=	Base	0/44/6	0/50/0	0/50/0	0/40/10	0/50/0	0/50/0

Table 3: The comparison results of MTEA-ATS with other six algorithms on CEC19-MaTSO3 problem

	MTEA-ATS	KR-MTEA	BoKTDE	MTEA-SaO	AEMTO	MaTDE	DE
CEC19-MaTSO3-T1	3.53e+02	1.40e+02 +	3.30e+02 +	1.69e+02 +	2.17e+02 +	3.26e+02 =	4.59e+02 -
CEC19-MaTSO3-T2	3.53e+02	3.56e+02 =	3.44e+02 +	1.85e+02 +	2.29e+02 +	3.13e+02 +	4.59e+02 -
CEC19-MaTSO3-T3	3.50e+02	1.32e+02 +	3.34e+02 +	1.79e+02 +	2.34e+02 +	3.00e+02 +	4.49e+02 -
CEC19-MaTSO3-T4	3.54e+02	3.58e+02 =	3.41e+02 +	1.59e+02 +	2.36e+02 +	3.19e+02 +	4.56e+02 -
CEC19-MaTSO3-T5	3.53e+02	1.36e+02 +	3.33e+02 +	1.91e+02 +	2.19e+02 +	3.27e+02 =	4.55e+02 -
CEC19-MaTSO3-T6	3.53e+02	3.58e+02 =	3.36e+02 +	1.93e+02 +	2.29e+02 +	3.21e+02 +	4.59e+02 -
CEC19-MaTSO3-T7	3.57e+02	1.44e+02 +	3.40e+02 +	1.60e+02 +	2.30e+02 +	2.84e+02 +	4.57e+02 -
CEC19-MaTSO3-T8	3.54e+02	3.54e+02 =	3.41e+02 +	1.91e+02 +	1.97e+02 +	3.40e+02 =	4.61e+02 -
CEC19-MaTSO3-T9	3.58e+02	1.40e+02 +	3.41e+02 +	1.84e+02 +	1.95e+02 +	2.91e+02 +	4.57e+02 -
CEC19-MaTSO3-T10	3.55e+02	3.60e+02 =	3.40e+02 +	1.96e+02 +	2.03e+02 +	3.22e+02 +	4.59e+02 -
CEC19-MaTSO3-T11	3.54e+02	1.41e+02 +	3.42e+02 +	1.76e+02 +	2.46e+02 +	3.37e+02 =	4.63e+02 -
CEC19-MaTSO3-T12	3.51e+02	3.56e+02 =	3.42e+02 +	1.85e+02 +	1.96e+02 +	3.16e+02 +	4.63e+02 -
CEC19-MaTSO3-T13	3.52e+02	1.39e+02 +	3.40e+02 +	2.16e+02 +	2.41e+02 +	3.28e+02 =	4.56e+02 -
CEC19-MaTSO3-T14	3.53e+02	3.59e+02 =	3.42e+02 +	1.79e+02 +	2.24e+02 +	3.14e+02 =	4.57e+02 -
CEC19-MaTSO3-T15	3.54e+02	1.50e+02 +	3.40e+02 +	1.69e+02 +	2.22e+02 +	3.17e+02 +	4.56e+02 -
CEC19-MaTSO3-T16	3.52e+02	3.58e+02 =	3.39e+02 +	1.65e+02 +	2.14e+02 +	3.18e+02 =	4.63e+02 -
CEC19-MaTSO3-T17	3.56e+02	1.37e+02 +	3.39e+02 +	1.92e+02 +	2.08e+02 +	3.10e+02 +	4.63e+02 -
CEC19-MaTSO3-T18	3.52e+02	3.60e+02 =	3.42e+02 +	1.75e+02 +	2.03e+02 +	3.23e+02 +	4.60e+02 -
CEC19-MaTSO3-T19	3.55e+02	1.44e+02 +	3.42e+02 +	2.00e+02 +	2.25e+02 +	3.05e+02 +	4.62e+02 -
CEC19-MaTSO3-T20	3.49e+02	3.51e+02 =	3.41e+02 =	1.71e+02 +	2.29e+02 +	3.23e+02 =	4.57e+02 -
CEC19-MaTSO3-T21	3.53e+02	1.43e+02 +	3.45e+02 +	1.75e+02 +	2.37e+02 +	3.30e+02 =	4.56e+02 -
CEC19-MaTSO3-T22	3.56e+02	3.62e+02 =	3.37e+02 +	1.61e+02 +	2.37e+02 +	3.24e+02 +	4.57e+02 -
CEC19-MaTSO3-T23	3.53e+02	1.24e+02 +	3.43e+02 =	1.73e+02 +	2.57e+02 +	3.43e+02 =	4.62e+02 -
CEC19-MaTSO3-T24	3.58e+02	3.58e+02 =	3.42e+02 +	1.82e+02 +	1.95e+02 +	3.32e+02 +	4.56e+02 -
CEC19-MaTSO3-T25	3.54e+02	1.28e+02 +	3.47e+02 =	1.89e+02 +	2.24e+02 +	3.06e+02 +	4.56e+02 -
CEC19-MaTSO3-T26	3.54e+02	3.56e+02 =	3.42e+02 +	1.82e+02 +	2.34e+02 +	3.54e+02 =	4.61e+02 -
CEC19-MaTSO3-T27	3.53e+02	1.31e+02 +	3.44e+02 =	1.95e+02 +	2.03e+02 +	3.20e+02 +	4.60e+02 -
CEC19-MaTSO3-T28	3.50e+02	3.38e+02 =	3.36e+02 +	1.74e+02 +	2.59e+02 +	3.00e+02 +	4.57e+02 -
CEC19-MaTSO3-T29	3.57e+02	1.20e+02 +	3.40e+02 +	1.72e+02 +	2.58e+02 +	3.20e+02 +	4.58e+02 -
CEC19-MaTSO3-T30	3.49e+02	3.56e+02 =	3.39e+02 =	1.87e+02 +	2.19e+02 +	3.07e+02 +	4.61e+02 -
CEC19-MaTSO3-T31	3.53e+02	1.36e+02 +	3.38e+02 +	1.98e+02 +	2.21e+02 +	3.15e+02 +	4.64e+02 -
CEC19-MaTSO3-T32	3.56e+02	3.56e+02 =	3.40e+02 +	1.95e+02 +	2.26e+02 +	3.32e+02 =	4.58e+02 -
CEC19-MaTSO3-T33	3.51e+02	1.51e+02 +	3.40e+02 +	1.84e+02 +	2.76e+02 +	2.91e+02 +	4.57e+02 -
CEC19-MaTSO3-T34	3.53e+02	3.49e+02 =	3.32e+02 +	1.59e+02 +	2.28e+02 +	3.17e+02 +	4.63e+02 -
CEC19-MaTSO3-T35	3.50e+02	1.34e+02 +	3.45e+02 =	1.93e+02 +	2.44e+02 +	3.37e+02 =	4.53e+02 -
CEC19-MaTSO3-T36	3.51e+02	3.62e+02 -	3.42e+02 +	2.04e+02 +	2.11e+02 +	3.26e+02 +	4.62e+02 -
CEC19-MaTSO3-T37	3.53e+02	1.40e+02 +	3.39e+02 +	1.86e+02 +	2.16e+02 +	3.35e+02 =	4.57e+02 -
CEC19-MaTSO3-T38	3.60e+02	3.62e+02 =	3.40e+02 +	1.95e+02 +	2.38e+02 +	3.18e+02 +	4.60e+02 -
CEC19-MaTSO3-T39	3.52e+02	1.31e+02 +	3.40e+02 +	1.81e+02 +	2.32e+02 +	3.34e+02 =	4.54e+02 -
CEC19-MaTSO3-T40	3.56e+02	3.56e+02 =	3.42e+02 +	1.67e+02 +	2.28e+02 +	3.21e+02 +	4.56e+02 -
CEC19-MaTSO3-T41	3.52e+02	1.35e+02 +	3.43e+02 =	1.81e+02 +	2.00e+02 +	3.26e+02 =	4.56e+02 -
CEC19-MaTSO3-T42	3.51e+02	3.59e+02 =	3.43e+02 =	1.74e+02 +	2.15e+02 +	3.25e+02 =	4.60e+02 -
CEC19-MaTSO3-T43	3.49e+02	1.40e+02 +	3.42e+02 =	1.63e+02 +	2.04e+02 +	3.35e+02 =	4.57e+02 -
CEC19-MaTSO3-T44	3.52e+02	3.56e+02 =	3.39e+02 +	1.84e+02 +	2.36e+02 +	3.28e+02 +	4.59e+02 -
CEC19-MaTSO3-T45	3.54e+02	1.27e+02 +	3.40e+02 +	1.77e+02 +	1.74e+02 +	3.23e+02 =	4.58e+02 -
CEC19-MaTSO3-T46	3.56e+02	3.61e+02 =	3.43e+02 +	1.73e+02 +	2.51e+02 +	3.07e+02 +	4.55e+02 -
CEC19-MaTSO3-T47	3.49e+02	1.58e+02 +	3.47e+02 =	1.79e+02 +	2.00e+02 +	3.09e+02 +	4.60e+02 -
CEC19-MaTSO3-T48	3.55e+02	3.56e+02 =	3.46e+02 +	1.87e+02 +	2.25e+02 +	3.14e+02 +	4.61e+02 -
CEC19-MaTSO3-T49	3.51e+02	1.38e+02 +	3.41e+02 +	1.90e+02 +	2.48e+02 +	3.41e+02 =	4.56e+02 -
CEC19-MaTSO3-T50	3.54e+02	3.60e+02 =	3.43e+02 +	1.69e+02 +	2.26e+02 +	3.11e+02 =	4.61e+02 -
+/-/=	Base	25/1/24	40/0/10	50/0/0	50/0/0	26/0/24	0/50/0

Table 4: The comparison results of MTEA-ATS with other six algorithms on CEC19-MaTSO4 problem

	MTEA-ATS	KR-MTEA	BoKTDE	MTEA-SaO	AEMTO	MaTDE	DE
CEC19-MaTSO4-T1	2.61e-07	1.74e-02 -	3.70e-04 -	1.57e-03 -	5.87e-03 -	1.15e-02 -	3.42e-01 -
CEC19-MaTSO4-T2	6.39e-06	1.17e-07 =	8.08e-09 +	1.07e-03 -	3.26e-03 -	6.13e-03 -	3.45e-01 -
CEC19-MaTSO4-T3	9.96e-06	1.76e-02 -	7.10e-09 +	5.05e-04 -	2.20e-03 -	6.89e-03 -	3.20e-01 -
CEC19-MaTSO4-T4	3.72e-04	7.76e-08 =	2.40e-07 +	3.84e-04 -	3.60e-03 -	1.86e-02 -	3.55e-01 -
CEC19-MaTSO4-T5	7.46e-04	1.91e-02 -	3.70e-04 +	8.65e-04 -	4.43e-03 -	5.36e-03 -	3.34e-01 -
CEC19-MaTSO4-T6	1.60e-06	8.83e-08 =	3.71e-04 -	1.14e-03 -	1.05e-02 -	5.92e-03 -	3.75e-01 -
CEC19-MaTSO4-T7	1.04e-06	1.81e-02 -	2.02e-07 =	4.60e-04 -	3.85e-03 -	7.28e-03 -	3.34e-01 -
CEC19-MaTSO4-T8	1.99e-06	5.24e-08 =	2.09e-08 +	8.70e-04 -	4.05e-03 -	5.04e-03 -	3.42e-01 -
CEC19-MaTSO4-T9	1.19e-07	1.89e-02 -	1.02e-06 -	1.45e-03 -	4.23e-03 -	7.68e-03 -	3.59e-01 -
CEC19-MaTSO4-T10	3.72e-04	1.92e-07 =	4.01e-07 +	1.61e-03 -	4.77e-03 -	6.79e-03 -	3.35e-01 -
CEC19-MaTSO4-T11	2.25e-06	1.82e-02 -	1.80e-06 =	4.66e-04 -	5.20e-03 -	5.01e-03 -	3.59e-01 -
CEC19-MaTSO4-T12	7.98e-09	1.22e-07 -	1.44e-07 =	1.94e-03 -	3.93e-03 -	9.34e-03 -	3.47e-01 -
CEC19-MaTSO4-T13	3.06e-07	1.68e-02 -	1.26e-07 =	8.49e-04 -	6.93e-03 -	5.76e-03 -	3.55e-01 -
CEC19-MaTSO4-T14	1.35e-07	4.10e-08 =	5.98e-08 =	3.82e-04 -	1.70e-02 -	8.21e-03 -	3.59e-01 -
CEC19-MaTSO4-T15	1.17e-07	1.36e-02 -	2.41e-07 =	4.21e-04 -	2.15e-03 -	5.37e-03 -	3.42e-01 -
CEC19-MaTSO4-T16	7.33e-06	8.41e-08 =	1.16e-08 +	8.84e-04 -	2.97e-03 -	4.27e-03 -	3.44e-01 -
CEC19-MaTSO4-T17	1.48e-06	1.50e-02 -	6.31e-08 +	4.55e-04 -	2.89e-03 -	7.60e-03 -	3.35e-01 -
CEC19-MaTSO4-T18	1.29e-06	7.08e-08 =	1.66e-08 +	5.34e-04 -	3.80e-03 -	6.60e-03 -	3.36e-01 -
CEC19-MaTSO4-T19	2.91e-07	1.67e-02 -	3.48e-08 +	4.78e-04 -	3.52e-03 -	7.35e-03 -	3.37e-01 -
CEC19-MaTSO4-T20	7.35e-06	4.99e-08 =	3.70e-04 -	1.46e-03 -	6.63e-03 -	5.93e-03 -	3.43e-01 -
CEC19-MaTSO4-T21	3.77e-04	2.06e-02 -	1.97e-08 +	1.21e-03 -	4.78e-03 -	5.78e-03 -	3.59e-01 -
CEC19-MaTSO4-T22	1.14e-07	7.11e-08 =	6.26e-09 +	4.71e-04 -	1.08e-02 -	1.02e-02 -	3.58e-01 -
CEC19-MaTSO4-T23	1.23e-07	1.60e-02 -	5.63e-08 =	4.29e-04 -	4.02e-03 -	1.32e-02 -	3.37e-01 -
CEC19-MaTSO4-T24	8.98e-06	1.84e-08 +	4.21e-08 +	4.53e-04 -	1.74e-03 -	4.71e-03 -	3.37e-01 -
CEC19-MaTSO4-T25	5.37e-07	1.34e-02 -	9.08e-08 +	1.39e-03 -	2.45e-03 -	7.96e-03 -	3.34e-01 -
CEC19-MaTSO4-T26	7.69e-06	1.07e-07 =	7.56e-07 +	3.79e-04 -	9.96e-03 -	5.47e-03 -	3.23e-01 -
CEC19-MaTSO4-T27	8.83e-06	1.72e-02 -	1.07e-07 +	5.07e-04 -	5.25e-03 -	6.39e-03 -	3.43e-01 -
CEC19-MaTSO4-T28	2.04e-06	2.56e-08 =	1.49e-06 +	1.02e-03 -	1.58e-03 -	1.11e-02 -	3.54e-01 -
CEC19-MaTSO4-T29	2.71e-06	1.88e-02 -	1.23e-07 +	3.95e-04 -	6.83e-03 -	1.18e-02 -	3.50e-01 -
CEC19-MaTSO4-T30	1.26e-06	2.37e-08 +	7.54e-07 +	8.99e-04 -	6.04e-03 -	3.41e-03 -	3.57e-01 -
CEC19-MaTSO4-T31	6.18e-04	1.77e-02 -	5.15e-09 +	4.25e-04 +	7.32e-03 -	3.24e-03 -	3.40e-01 -
CEC19-MaTSO4-T32	7.91e-07	2.16e-08 =	1.31e-07 +	1.27e-03 -	8.70e-03 -	9.73e-03 -	3.66e-01 -
CEC19-MaTSO4-T33	3.73e-06	1.46e-02 -	3.52e-08 +	1.74e-03 -	4.40e-03 -	3.87e-03 -	3.45e-01 -
CEC19-MaTSO4-T34	8.08e-06	8.76e-08 =	2.38e-08 +	8.45e-04 -	6.92e-03 -	3.96e-03 -	3.50e-01 -
CEC19-MaTSO4-T35	3.70e-04	1.72e-02 -	1.32e-07 +	4.26e-04 -	6.00e-03 -	4.02e-03 -	3.52e-01 -
CEC19-MaTSO4-T36	1.95e-06	1.51e-07 =	2.22e-07 +	3.98e-04 -	5.20e-03 -	1.05e-02 -	3.47e-01 -
CEC19-MaTSO4-T37	2.19e-06	2.14e-02 -	1.01e-07 +	9.08e-04 -	2.31e-03 -	6.33e-03 -	3.36e-01 -
CEC19-MaTSO4-T38	1.25e-05	1.46e-07 =	4.70e-09 +	4.26e-04 -	3.08e-03 -	4.37e-03 -	3.47e-01 -
CEC19-MaTSO4-T39	5.15e-07	1.21e-02 -	0.00e+00 +	1.27e-03 -	8.46e-03 -	6.97e-03 -	3.33e-01 -
CEC19-MaTSO4-T40	4.63e-07	3.43e-08 =	4.61e-09 +	4.17e-04 -	9.08e-03 -	4.88e-03 -	3.53e-01 -
CEC19-MaTSO4-T41	4.64e-06	1.59e-02 -	1.64e-08 +	5.22e-04 -	9.66e-03 -	5.93e-03 -	3.72e-01 -
CEC19-MaTSO4-T42	1.18e-06	1.01e-07 =	1.50e-08 +	8.45e-04 -	4.36e-03 -	8.50e-03 -	3.51e-01 -
CEC19-MaTSO4-T43	4.24e-07	1.68e-02 -	1.31e-08 =	1.42e-03 -	6.75e-03 -	7.40e-03 -	3.57e-01 -
CEC19-MaTSO4-T44	1.50e-05	9.09e-08 +	4.97e-07 +	4.26e-04 -	4.97e-03 -	5.83e-03 -	3.57e-01 -
CEC19-MaTSO4-T45	5.16e-07	1.58e-02 -	3.10e-08 +	1.43e-03 -	6.60e-03 -	4.25e-03 -	3.41e-01 -
CEC19-MaTSO4-T46	6.91e-06	6.86e-08 =	6.53e-08 +	8.55e-04 -	3.44e-03 -	4.74e-03 -	3.60e-01 -
CEC19-MaTSO4-T47	8.24e-07	1.80e-02 -	4.07e-08 +	4.44e-04 -	4.80e-03 -	4.00e-03 -	3.64e-01 -
CEC19-MaTSO4-T48	7.54e-06	1.17e-07 =	1.59e-07 +	3.81e-04 -	8.95e-03 -	7.24e-03 -	3.54e-01 -
CEC19-MaTSO4-T49	6.78e-06	1.73e-02 -	1.94e-08 +	4.47e-04 -	2.60e-03 -	8.03e-03 -	3.53e-01 -
CEC19-MaTSO4-T50	3.83e-06	1.23e-07 =	4.96e-07 +	1.96e-03 -	3.38e-03 -	6.20e-03 -	3.36e-01 -
+/-/=	Base	3/26/21	38/4/8	1/49/0	0/50/0	0/50/0	0/50/0

Table 5: The comparison results of MTEA-ATS with other six algorithms on CEC19-MaTSO5 problem

	MTEA-ATS	KR-MTEA	BoKTDE	MTEA-SaO	AEMTO	MaTDE	DE
CEC19-MaTSO5-T1	8.84e-04	5.00e-01 -	2.57e-02 -	2.51e-01 -	3.33e-02 -	1.73e-01 -	1.38e+00 -
CEC19-MaTSO5-T2	7.09e-02	4.45e-03 +	5.96e-02 =	2.33e-01 -	5.31e-02 +	2.18e-01 -	1.37e+00 -
CEC19-MaTSO5-T3	1.69e-03	4.99e-01 -	4.40e-02 =	2.37e-01 -	5.05e-02 =	1.38e-01 -	1.38e+00 -
CEC19-MaTSO5-T4	1.09e-03	4.08e-03 -	4.83e-03 =	2.40e-01 -	6.02e-02 -	2.64e-01 -	1.40e+00 -
CEC19-MaTSO5-T5	7.72e-04	5.06e-01 -	1.32e-02 =	2.17e-01 -	3.17e-02 =	3.23e-01 -	1.42e+00 -
CEC19-MaTSO5-T6	5.58e-04	4.87e-03 -	1.28e-02 =	2.21e-01 -	4.22e-02 -	2.71e-01 -	1.36e+00 -
CEC19-MaTSO5-T7	2.37e-02	4.90e-01 -	3.99e-02 =	2.69e-01 -	4.46e-02 -	2.00e-01 -	1.39e+00 -
CEC19-MaTSO5-T8	1.92e-04	2.20e-03 -	9.69e-03 =	2.30e-01 -	1.73e-02 -	3.91e-01 -	1.36e+00 -
CEC19-MaTSO5-T9	2.37e-02	4.96e-01 -	3.39e-02 -	2.37e-01 -	8.38e-02 -	2.99e-01 -	1.36e+00 -
CEC19-MaTSO5-T10	1.76e-03	5.26e-03 -	1.41e-02 =	2.40e-01 -	3.41e-02 =	1.87e-01 -	1.41e+00 -
CEC19-MaTSO5-T11	1.30e-03	5.04e-01 -	4.91e-02 =	2.30e-01 -	2.49e-02 -	2.20e-01 -	1.43e+00 -
CEC19-MaTSO5-T12	2.87e-04	3.64e-03 -	1.83e-02 =	2.48e-01 -	2.22e-02 -	1.77e-01 -	1.38e+00 -
CEC19-MaTSO5-T13	7.65e-04	4.92e-01 -	1.06e-02 =	2.42e-01 -	2.51e-02 -	2.40e-01 -	1.37e+00 -
CEC19-MaTSO5-T14	1.24e-03	2.72e-03 -	1.00e-02 =	2.49e-01 -	6.98e-02 -	2.63e-01 -	1.38e+00 -
CEC19-MaTSO5-T15	6.90e-04	4.82e-01 -	1.87e-02 -	2.22e-01 -	4.05e-02 -	2.64e-01 -	1.38e+00 -
CEC19-MaTSO5-T16	7.12e-02	1.65e-03 +	3.02e-02 +	2.39e-01 -	6.94e-02 =	3.09e-01 -	1.39e+00 -
CEC19-MaTSO5-T17	3.38e-04	5.17e-01 -	9.66e-03 =	2.28e-01 -	4.02e-02 -	1.82e-01 -	1.40e+00 -
CEC19-MaTSO5-T18	1.58e-03	4.86e-03 -	1.18e-02 =	2.30e-01 -	2.67e-02 =	1.22e-01 -	1.36e+00 -
CEC19-MaTSO5-T19	6.89e-02	4.90e-01 -	1.40e-02 =	2.10e-01 -	4.02e-02 =	3.17e-01 -	1.39e+00 -
CEC19-MaTSO5-T20	1.83e-03	3.18e-03 -	1.18e-01 =	2.36e-01 -	1.26e-02 -	2.31e-01 -	1.36e+00 -
CEC19-MaTSO5-T21	4.99e-02	4.34e-01 -	5.49e-02 =	2.21e-01 -	1.56e-02 =	2.90e-01 -	1.35e+00 -
CEC19-MaTSO5-T22	7.45e-04	2.61e-03 -	1.72e-02 =	2.66e-01 -	4.64e-02 -	2.49e-01 -	1.37e+00 -
CEC19-MaTSO5-T23	1.01e-03	4.74e-01 -	5.51e-02 -	2.37e-01 -	3.33e-02 -	1.92e-01 -	1.34e+00 -
CEC19-MaTSO5-T24	5.91e-04	2.09e-03 -	2.55e-02 -	2.39e-01 -	1.76e-02 =	2.55e-01 -	1.39e+00 -
CEC19-MaTSO5-T25	5.34e-04	5.39e-01 -	1.43e-02 =	2.46e-01 -	5.21e-02 -	3.77e-01 -	1.39e+00 -
CEC19-MaTSO5-T26	6.91e-04	1.93e-03 -	2.09e-02 =	2.45e-01 -	4.99e-02 -	3.22e-01 -	1.37e+00 -
CEC19-MaTSO5-T27	7.35e-04	4.63e-01 -	1.32e-02 =	2.39e-01 -	1.83e-02 -	1.70e-01 -	1.38e+00 -
CEC19-MaTSO5-T28	9.07e-04	4.13e-03 -	1.52e-02 -	2.34e-01 -	4.20e-02 -	2.37e-01 -	1.35e+00 -
CEC19-MaTSO5-T29	9.32e-04	4.72e-01 -	1.09e-02 =	2.42e-01 -	5.10e-02 -	1.42e-01 -	1.41e+00 -
CEC19-MaTSO5-T30	3.85e-04	3.93e-03 -	5.90e-02 =	2.52e-01 -	5.79e-02 -	1.83e-01 -	1.40e+00 -
CEC19-MaTSO5-T31	1.09e-03	4.34e-01 -	2.07e-02 =	2.52e-01 -	5.14e-02 =	1.72e-01 -	1.39e+00 -
CEC19-MaTSO5-T32	8.81e-04	1.73e-03 -	1.49e-02 =	2.26e-01 -	4.60e-02 -	1.64e-01 -	1.40e+00 -
CEC19-MaTSO5-T33	9.69e-04	5.00e-01 -	1.71e-02 =	2.43e-01 -	1.60e-02 -	3.64e-01 -	1.39e+00 -
CEC19-MaTSO5-T34	4.17e-04	2.84e-03 -	2.98e-02 =	2.31e-01 -	7.98e-02 -	2.52e-01 -	1.37e+00 -
CEC19-MaTSO5-T35	2.67e-04	5.09e-01 -	1.13e-02 =	2.48e-01 -	4.51e-02 -	3.18e-01 -	1.40e+00 -
CEC19-MaTSO5-T36	7.67e-04	4.50e-03 -	3.22e-02 =	2.49e-01 -	6.49e-02 -	2.25e-01 -	1.40e+00 -
CEC19-MaTSO5-T37	1.27e-03	4.56e-01 -	5.76e-03 =	2.35e-01 -	6.37e-02 -	1.98e-01 -	1.37e+00 -
CEC19-MaTSO5-T38	4.49e-02	1.85e-03 +	1.31e-02 +	2.36e-01 -	1.01e-01 -	2.48e-01 -	1.38e+00 -
CEC19-MaTSO5-T39	8.60e-04	5.21e-01 -	6.94e-02 =	2.48e-01 -	2.68e-02 -	2.40e-01 -	1.35e+00 -
CEC19-MaTSO5-T40	6.15e-04	3.96e-03 -	3.13e-02 =	2.57e-01 -	1.98e-02 -	2.44e-01 -	1.37e+00 -
CEC19-MaTSO5-T41	7.05e-04	4.73e-01 -	2.88e-02 -	2.52e-01 -	5.62e-02 +	2.02e-01 -	1.37e+00 -
CEC19-MaTSO5-T42	1.51e-03	1.82e-03 -	1.46e-03 =	2.66e-01 -	3.04e-02 =	1.85e-01 -	1.35e+00 -
CEC19-MaTSO5-T43	6.93e-04	4.73e-01 -	8.54e-03 =	2.46e-01 -	5.50e-02 -	1.66e-01 -	1.33e+00 -
CEC19-MaTSO5-T44	4.20e-04	4.53e-03 -	2.83e-03 =	2.44e-01 -	3.41e-02 -	1.96e-01 -	1.34e+00 -
CEC19-MaTSO5-T45	7.06e-04	4.99e-01 -	3.45e-04 +	2.45e-01 -	3.98e-02 -	1.81e-01 -	1.34e+00 -
CEC19-MaTSO5-T46	9.33e-04	2.73e-03 -	1.05e-02 =	2.09e-01 -	3.60e-02 -	2.64e-01 -	1.34e+00 -
CEC19-MaTSO5-T47	8.49e-04	5.25e-01 -	3.55e-03 =	2.23e-01 -	3.55e-02 -	2.04e-01 -	1.39e+00 -
CEC19-MaTSO5-T48	5.29e-04	3.00e-03 -	2.15e-02 =	2.13e-01 -	2.94e-02 =	3.35e-01 -	1.39e+00 -
CEC19-MaTSO5-T49	4.97e-04	5.67e-01 -	2.50e-02 -	2.34e-01 -	4.90e-02 -	3.86e-01 -	1.40e+00 -
CEC19-MaTSO5-T50	1.31e-03	2.00e-03 -	9.66e-03 =	2.51e-01 -	2.75e-02 -	2.52e-01 -	1.41e+00 -
+/-/=	Base	3/47/0	3/8/39	0/50/0	1/39/10	0/50/0	0/50/0

Table 6: The comparison results of MTEA-ATS with other six algorithms on CEC19-MaTSO6 problem

	MTEA-ATS	KR-MTEA	BoKTDE	MTEA-SaO	AEMTO	MaTDE	DE
CEC19-MaTSO6-T1	6.36e-04	1.19e+01 -	1.20e+04 -	1.19e+03 -	2.94e+02 -	3.15e-03 -	9.37e+03 -
CEC19-MaTSO6-T2	6.36e-04	6.36e-04 -	1.27e+04 -	1.22e+03 -	2.80e+02 -	2.76e-03 -	1.03e+04 -
CEC19-MaTSO6-T3	6.36e-04	1.05e-02 -	1.22e+04 -	1.20e+03 -	3.52e+02 -	2.44e-03 -	9.97e+03 -
CEC19-MaTSO6-T4	6.36e-04	6.36e-04 =	1.21e+04 -	1.08e+03 -	2.08e+02 -	2.56e-03 -	9.35e+03 -
CEC19-MaTSO6-T5	6.36e-04	9.62e-03 -	1.17e+04 -	1.36e+03 -	2.63e+02 -	2.53e-03 -	8.84e+03 -
CEC19-MaTSO6-T6	6.36e-04	6.36e-04 -	1.20e+04 -	1.27e+03 -	2.43e+02 -	2.55e-03 -	9.57e+03 -
CEC19-MaTSO6-T7	6.36e-04	6.92e-03 -	1.12e+04 -	1.19e+03 -	2.21e+02 -	2.28e-03 -	8.35e+03 -
CEC19-MaTSO6-T8	6.36e-04	6.36e-04 -	1.28e+04 -	1.27e+03 -	2.37e+02 -	2.75e-03 -	1.06e+04 -
CEC19-MaTSO6-T9	6.36e-04	9.13e-03 -	1.24e+04 -	1.21e+03 -	2.33e+02 -	2.58e-03 -	1.06e+04 -
CEC19-MaTSO6-T10	6.36e-04	6.36e-04 +	1.11e+04 -	1.26e+03 -	2.13e+02 -	2.87e-03 -	7.68e+03 -
CEC19-MaTSO6-T11	6.36e-04	7.22e-03 -	1.28e+04 -	1.40e+03 -	2.24e+02 -	1.95e-03 -	1.15e+04 -
CEC19-MaTSO6-T12	6.36e-04	6.36e-04 -	1.18e+04 -	1.29e+03 -	2.47e+02 -	3.28e-03 -	9.14e+03 -
CEC19-MaTSO6-T13	6.36e-04	5.93e+00 -	1.18e+04 -	1.42e+03 -	1.89e+02 -	2.89e-03 -	9.25e+03 -
CEC19-MaTSO6-T14	6.36e-04	6.36e-04 -	1.22e+04 -	1.25e+03 -	2.19e+02 -	2.71e-03 -	1.01e+04 -
CEC19-MaTSO6-T15	6.36e-04	7.72e-03 -	1.26e+04 -	1.21e+03 -	1.95e+02 -	2.31e-03 -	1.02e+04 -
CEC19-MaTSO6-T16	6.36e-04	6.36e-04 =	1.14e+04 -	1.28e+03 -	2.91e+02 -	2.67e-03 -	8.79e+03 -
CEC19-MaTSO6-T17	6.36e-04	9.72e-03 -	1.19e+04 -	1.22e+03 -	2.25e+02 -	2.14e-03 -	9.56e+03 -
CEC19-MaTSO6-T18	6.36e-04	6.36e-04 =	1.17e+04 -	1.27e+03 -	2.42e+02 -	2.53e-03 -	9.12e+03 -
CEC19-MaTSO6-T19	6.36e-04	1.00e-02 -	1.19e+04 -	1.19e+03 -	2.41e+02 -	2.67e-03 -	9.31e+03 -
CEC19-MaTSO6-T20	6.36e-04	6.36e-04 -	1.04e+04 -	1.22e+03 -	2.27e+02 -	3.02e-03 -	7.47e+03 -
CEC19-MaTSO6-T21	6.36e-04	8.63e-03 -	1.17e+04 -	1.23e+03 -	2.29e+02 -	3.36e-03 -	9.10e+03 -
CEC19-MaTSO6-T22	6.36e-04	6.36e-04 =	1.21e+04 -	1.14e+03 -	2.45e+02 -	2.00e-03 -	9.82e+03 -
CEC19-MaTSO6-T23	6.36e-04	1.17e-02 -	1.20e+04 -	1.34e+03 -	2.37e+02 -	2.51e-03 -	9.96e+03 -
CEC19-MaTSO6-T24	6.36e-04	6.36e-04 -	1.16e+04 -	1.22e+03 -	2.63e+02 -	2.86e-03 -	9.32e+03 -
CEC19-MaTSO6-T25	6.36e-04	9.91e-03 -	1.18e+04 -	1.26e+03 -	2.10e+02 -	2.63e-03 -	9.40e+03 -
CEC19-MaTSO6-T26	6.36e-04	6.36e-04 =	1.30e+04 -	1.21e+03 -	2.70e+02 -	2.29e-03 -	1.10e+04 -
CEC19-MaTSO6-T27	6.36e-04	8.85e-03 -	1.21e+04 -	1.17e+03 -	2.65e+02 -	5.46e-03 -	9.66e+03 -
CEC19-MaTSO6-T28	6.36e-04	6.36e-04 =	1.08e+04 -	1.27e+03 -	2.71e+02 -	3.21e-03 -	8.19e+03 -
CEC19-MaTSO6-T29	6.36e-04	2.43e+00 -	1.13e+04 -	1.30e+03 -	2.00e+02 -	2.56e-03 -	9.14e+03 -
CEC19-MaTSO6-T30	6.36e-04	6.36e-04 =	1.17e+04 -	1.17e+03 -	2.31e+02 -	2.40e-03 -	9.51e+03 -
CEC19-MaTSO6-T31	6.36e-04	7.60e-03 -	1.17e+04 -	1.29e+03 -	2.24e+02 -	2.83e-03 -	9.48e+03 -
CEC19-MaTSO6-T32	6.36e-04	6.36e-04 =	1.21e+04 -	1.30e+03 -	2.50e+02 -	2.30e-03 -	1.02e+04 -
CEC19-MaTSO6-T33	6.36e-04	7.51e-03 -	1.18e+04 -	1.33e+03 -	2.19e+02 -	2.64e-03 -	9.66e+03 -
CEC19-MaTSO6-T34	6.36e-04	6.36e-04 -	1.26e+04 -	1.36e+03 -	2.70e+02 -	2.50e-03 -	1.08e+04 -
CEC19-MaTSO6-T35	6.36e-04	8.93e-03 -	1.20e+04 -	1.28e+03 -	2.19e+02 -	2.66e-03 -	9.91e+03 -
CEC19-MaTSO6-T36	6.36e-04	6.36e-04 -	1.08e+04 -	1.35e+03 -	2.32e+02 -	3.06e-03 -	8.44e+03 -
CEC19-MaTSO6-T37	6.36e-04	7.90e-03 -	1.19e+04 -	1.24e+03 -	2.70e+02 -	4.96e-03 -	9.93e+03 -
CEC19-MaTSO6-T38	6.36e-04	6.36e-04 =	1.17e+04 -	1.30e+03 -	2.38e+02 -	2.27e-03 -	9.86e+03 -
CEC19-MaTSO6-T39	6.36e-04	8.06e-03 -	1.17e+04 -	1.05e+03 -	2.43e+02 -	3.22e-03 -	9.83e+03 -
CEC19-MaTSO6-T40	6.36e-04	6.36e-04 =	1.18e+04 -	1.30e+03 -	2.72e+02 -	2.62e-03 -	9.77e+03 -
CEC19-MaTSO6-T41	6.36e-04	5.93e+00 -	1.11e+04 -	1.31e+03 -	2.27e+02 -	2.68e-03 -	9.21e+03 -
CEC19-MaTSO6-T42	6.36e-04	6.36e-04 -	1.25e+04 -	1.29e+03 -	2.64e+02 -	2.17e-03 -	1.08e+04 -
CEC19-MaTSO6-T43	6.36e-04	7.73e-03 -	1.09e+04 -	1.03e+03 -	2.32e+02 -	2.33e-03 -	8.91e+03 -
CEC19-MaTSO6-T44	6.36e-04	6.36e-04 -	1.17e+04 -	1.39e+03 -	2.54e+02 -	2.89e-03 -	9.65e+03 -
CEC19-MaTSO6-T45	6.36e-04	8.19e-03 -	1.07e+04 -	1.26e+03 -	2.70e+02 -	3.26e-03 -	8.77e+03 -
CEC19-MaTSO6-T46	6.36e-04	6.36e-04 -	1.04e+04 -	1.26e+03 -	2.37e+02 -	3.38e-03 -	8.55e+03 -
CEC19-MaTSO6-T47	6.36e-04	6.78e+00 -	1.24e+04 -	1.24e+03 -	2.71e+02 -	4.15e-03 -	1.03e+04 -
CEC19-MaTSO6-T48	6.36e-04	6.36e-04 -	1.13e+04 -	1.14e+03 -	1.97e+02 -	2.59e-03 -	9.47e+03 -
CEC19-MaTSO6-T49	6.36e-04	6.68e-03 -	1.09e+04 -	1.24e+03 -	2.26e+02 -	3.25e-03 -	8.82e+03 -
CEC19-MaTSO6-T50	6.36e-04	6.36e-04 -	1.16e+04 -	1.19e+03 -	2.32e+02 -	2.97e-03 -	9.64e+03 -
+/-/=	Base	1/39/10	0/50/0	0/50/0	0/50/0	0/50/0	0/50/0

Table 7: The comparison results of MTEA-ATS with other six algorithms on WCCI20-MaTSO1 problem

	MTEA-ATS	KR-MTEA	BoKTDE	MTEA-SaO	AEMTO	MaTDE	DE
WCCI20-MaTSO1-T1	0.00e+00	8.39e-03 -	0.00e+00 =	3.84e-04 -	1.49e-04 -	7.38e-07 -	2.96e-02 -
WCCI20-MaTSO1-T2	0.00e+00	0.00e+00 =	0.00e+00 =	3.21e-04 -	5.66e-05 =	8.64e-06 -	3.20e-02 -
WCCI20-MaTSO1-T3	0.00e+00	9.03e-03 -	0.00e+00 =	4.12e-04 -	8.37e-06 =	1.68e-06 -	3.18e-02 -
WCCI20-MaTSO1-T4	0.00e+00	1.26e-08 =	0.00e+00 =	3.46e-04 -	2.59e-02 =	1.38e-06 -	3.26e-02 -
WCCI20-MaTSO1-T5	0.00e+00	8.96e-03 -	0.00e+00 =	4.17e-04 -	1.11e-07 -	1.29e-06 -	3.25e-02 -
WCCI20-MaTSO1-T6	0.00e+00	2.53e-08 =	0.00e+00 =	2.85e-04 -	9.37e-03 -	1.13e-06 -	2.96e-02 -
WCCI20-MaTSO1-T7	0.00e+00	9.80e-03 -	0.00e+00 =	3.20e-04 -	3.18e-04 -	1.23e-06 -	3.04e-02 -
WCCI20-MaTSO1-T8	0.00e+00	9.86e-10 =	0.00e+00 =	3.21e-04 -	4.72e-03 -	1.37e-06 -	3.13e-02 -
WCCI20-MaTSO1-T9	0.00e+00	7.71e-03 -	0.00e+00 =	3.13e-04 -	1.71e-02 -	1.09e-06 -	3.10e-02 -
WCCI20-MaTSO1-T10	0.00e+00	0.00e+00 =	0.00e+00 =	3.22e-04 -	3.94e-04 -	1.24e-06 -	3.11e-02 -
WCCI20-MaTSO1-T11	0.00e+00	8.35e-03 -	0.00e+00 =	3.14e-04 -	5.01e-03 -	1.15e-06 -	2.97e-02 -
WCCI20-MaTSO1-T12	0.00e+00	0.00e+00 =	0.00e+00 =	3.78e-04 -	1.80e-06 -	1.04e-06 -	3.06e-02 -
WCCI20-MaTSO1-T13	0.00e+00	6.37e-03 -	0.00e+00 =	3.92e-04 -	3.12e-04 -	1.23e-06 -	2.97e-02 -
WCCI20-MaTSO1-T14	0.00e+00	2.50e-08 =	0.00e+00 =	3.37e-04 -	1.95e-03 -	1.37e-06 -	3.20e-02 -
WCCI20-MaTSO1-T15	0.00e+00	1.18e-02 -	0.00e+00 =	3.24e-04 -	9.00e-03 -	1.06e-06 -	2.98e-02 -
WCCI20-MaTSO1-T16	0.00e+00	1.04e-08 =	0.00e+00 =	4.09e-04 -	6.38e-07 =	1.04e-06 -	3.04e-02 -
WCCI20-MaTSO1-T17	0.00e+00	6.93e-03 -	0.00e+00 =	3.95e-04 -	3.34e-04 =	1.93e-06 -	2.92e-02 -
WCCI20-MaTSO1-T18	0.00e+00	5.55e-10 =	0.00e+00 =	2.99e-04 -	6.31e-08 =	1.21e-06 -	3.13e-02 -
WCCI20-MaTSO1-T19	0.00e+00	8.41e-03 -	0.00e+00 =	3.10e-04 -	2.33e-05 -	1.33e-06 -	2.88e-02 -
WCCI20-MaTSO1-T20	0.00e+00	2.34e-09 =	0.00e+00 =	3.96e-04 -	1.40e-03 -	1.39e-06 -	3.38e-02 -
WCCI20-MaTSO1-T21	0.00e+00	1.04e-02 -	1.22e-06 =	2.87e-04 -	2.37e-04 -	9.97e-07 -	3.11e-02 -
WCCI20-MaTSO1-T22	0.00e+00	6.16e-09 =	0.00e+00 =	3.14e-04 -	2.68e-04 -	1.39e-06 -	2.99e-02 -
WCCI20-MaTSO1-T23	0.00e+00	8.10e-03 -	0.00e+00 =	3.70e-04 -	1.37e-01 -	1.45e-06 -	3.15e-02 -
WCCI20-MaTSO1-T24	0.00e+00	0.00e+00 =	0.00e+00 =	3.01e-04 -	1.55e-04 -	8.38e-07 -	3.44e-02 -
WCCI20-MaTSO1-T25	0.00e+00	8.40e-03 -	0.00e+00 =	3.09e-04 -	3.54e-03 -	9.54e-07 -	3.07e-02 -
WCCI20-MaTSO1-T26	0.00e+00	0.00e+00 =	0.00e+00 =	3.64e-04 -	0.00e+00 =	1.09e-06 -	3.41e-02 -
WCCI20-MaTSO1-T27	0.00e+00	9.32e-03 -	0.00e+00 =	4.32e-04 -	1.98e-03 =	1.27e-06 -	3.23e-02 -
WCCI20-MaTSO1-T28	0.00e+00	0.00e+00 =	0.00e+00 =	3.03e-04 -	8.99e-06 =	1.20e-06 -	3.37e-02 -
WCCI20-MaTSO1-T29	0.00e+00	7.90e-03 -	0.00e+00 =	3.23e-04 -	3.94e-02 =	1.69e-06 -	3.23e-02 -
WCCI20-MaTSO1-T30	0.00e+00	0.00e+00 =	0.00e+00 =	2.97e-04 -	9.54e-05 =	1.03e-06 -	2.99e-02 -
WCCI20-MaTSO1-T31	1.87e-09	8.77e-03 -	2.18e-06 =	4.09e-04 -	2.78e-04 =	1.63e-06 -	3.26e-02 -
WCCI20-MaTSO1-T32	0.00e+00	2.15e-08 =	0.00e+00 =	3.18e-04 -	7.02e-03 -	1.06e-06 -	3.17e-02 -
WCCI20-MaTSO1-T33	0.00e+00	8.69e-03 -	0.00e+00 =	3.96e-04 -	1.84e-02 =	1.05e-06 -	3.19e-02 -
WCCI20-MaTSO1-T34	0.00e+00	1.54e-09 =	0.00e+00 =	3.54e-04 -	3.68e-03 -	1.20e-06 -	3.24e-02 -
WCCI20-MaTSO1-T35	0.00e+00	1.03e-02 -	0.00e+00 =	3.63e-04 -	5.99e-03 -	1.25e-06 -	2.99e-02 -
WCCI20-MaTSO1-T36	0.00e+00	6.10e-10 =	0.00e+00 =	3.49e-04 -	7.94e-07 -	1.25e-06 -	3.18e-02 -
WCCI20-MaTSO1-T37	0.00e+00	7.03e-03 -	0.00e+00 =	2.93e-04 -	1.28e-03 =	9.50e-07 -	3.10e-02 -
WCCI20-MaTSO1-T38	0.00e+00	9.39e-09 =	0.00e+00 =	3.17e-04 -	4.27e-03 -	1.23e-06 -	3.15e-02 -
WCCI20-MaTSO1-T39	0.00e+00	7.91e-03 -	0.00e+00 =	2.95e-04 -	1.41e-06 -	2.87e-06 -	2.95e-02 -
WCCI20-MaTSO1-T40	0.00e+00	3.38e-09 =	0.00e+00 =	3.48e-04 -	4.26e-07 -	9.12e-07 -	3.42e-02 -
WCCI20-MaTSO1-T41	0.00e+00	7.43e-03 -	5.71e-10 =	2.54e-04 -	4.30e-03 -	8.51e-07 -	3.25e-02 -
WCCI20-MaTSO1-T42	1.56e-09	8.92e-09 =	0.00e+00 =	2.69e-04 -	5.08e-03 =	1.35e-06 -	2.74e-02 -
WCCI20-MaTSO1-T43	0.00e+00	9.26e-03 -	0.00e+00 =	3.80e-04 -	1.42e-02 -	1.02e-06 -	2.89e-02 -
WCCI20-MaTSO1-T44	0.00e+00	2.31e-09 =	0.00e+00 =	3.36e-04 -	6.70e-03 -	6.66e-07 -	3.35e-02 -
WCCI20-MaTSO1-T45	0.00e+00	8.85e-03 -	0.00e+00 =	3.49e-04 -	5.65e-04 -	2.39e-06 -	3.19e-02 -
WCCI20-MaTSO1-T46	0.00e+00	2.57e-09 =	0.00e+00 =	3.19e-04 -	1.28e-03 =	1.00e-06 -	2.99e-02 -
WCCI20-MaTSO1-T47	0.00e+00	9.82e-03 -	0.00e+00 =	2.56e-04 -	1.32e-02 -	1.39e-06 -	3.39e-02 -
WCCI20-MaTSO1-T48	0.00e+00	6.05e-10 =	0.00e+00 =	3.14e-04 -	2.01e-04 -	2.78e-06 -	2.88e-02 -
WCCI20-MaTSO1-T49	0.00e+00	9.53e-03 -	0.00e+00 =	2.97e-04 -	1.29e-06 =	1.10e-06 -	2.87e-02 -
WCCI20-MaTSO1-T50	1.33e-08	0.00e+00 =	0.00e+00 =	4.28e-04 -	3.81e-03 =	1.08e-06 -	2.84e-02 -
+/-/=	Base	0/25/25	0/0/50	0/50/0	0/29/21	0/50/0	0/50/0

Table 8: The comparison results of MTEA-ATS with other six algorithms on WCCI20-MaTSO2 problem

	MTEA-ATS	KR-MTEA	BoKTDE	MTEA-SaO	AEMTO	MaTDE	DE
WCCI20-MaTSO2-T1	4.76e+01	8.36e+01 -	4.83e+01 =	1.67e+02 -	1.37e+02 -	9.84e+01 -	2.63e+03 -
WCCI20-MaTSO2-T2	8.85e+01	1.20e+02 =	1.57e+02 -	2.60e+02 =	2.49e+02 =	2.17e+02 -	3.83e+03 -
WCCI20-MaTSO2-T3	5.44e+01	1.14e+02 -	1.33e+02 =	1.41e+02 -	2.70e+02 -	1.50e+02 -	4.61e+03 -
WCCI20-MaTSO2-T4	4.73e+01	4.73e+01 =	1.44e+02 -	2.46e+02 -	2.86e+02 -	2.04e+02 -	4.88e+03 -
WCCI20-MaTSO2-T5	7.91e+01	1.61e+02 -	1.25e+02 -	3.71e+02 -	1.63e+02 =	1.56e+02 -	5.16e+03 -
WCCI20-MaTSO2-T6	5.65e+01	4.75e+01 =	6.17e+01 =	7.92e+02 -	2.34e+02 -	1.28e+02 -	6.18e+03 -
WCCI20-MaTSO2-T7	4.75e+01	1.44e+02 -	9.13e+01 -	4.28e+02 -	1.55e+02 -	1.42e+02 -	2.51e+03 -
WCCI20-MaTSO2-T8	4.74e+01	4.73e+01 =	7.04e+01 -	5.34e+02 -	1.51e+02 -	7.86e+01 -	1.27e+03 -
WCCI20-MaTSO2-T9	5.34e+01	2.65e+02 -	1.79e+02 -	2.29e+02 -	4.79e+02 -	1.87e+02 -	6.51e+03 -
WCCI20-MaTSO2-T10	4.65e+01	5.01e+01 -	7.70e+01 -	2.69e+02 -	2.76e+02 -	8.42e+01 -	3.34e+03 -
WCCI20-MaTSO2-T11	4.78e+01	7.93e+01 -	5.36e+01 =	6.78e+01 -	2.26e+02 =	1.04e+02 -	1.58e+03 -
WCCI20-MaTSO2-T12	4.84e+01	4.79e+01 +	6.39e+01 =	2.19e+02 =	9.18e+01 -	1.05e+02 -	5.42e+03 -
WCCI20-MaTSO2-T13	4.76e+01	9.45e+01 -	1.27e+02 -	1.92e+02 -	2.75e+02 -	1.31e+02 -	3.42e+03 -
WCCI20-MaTSO2-T14	4.77e+01	4.77e+01 =	1.39e+02 -	9.47e+01 -	2.43e+02 -	1.23e+02 -	2.75e+03 -
WCCI20-MaTSO2-T15	5.11e+01	2.00e+02 -	2.94e+02 -	4.82e+02 -	4.83e+02 -	2.48e+02 -	3.00e+03 -
WCCI20-MaTSO2-T16	4.71e+01	4.70e+01 =	8.48e+01 -	9.69e+01 -	2.29e+02 -	6.47e+01 -	5.58e+03 -
WCCI20-MaTSO2-T17	4.78e+01	1.05e+02 -	5.79e+01 -	2.86e+02 -	2.63e+02 -	1.02e+02 -	9.14e+03 -
WCCI20-MaTSO2-T18	5.11e+01	4.92e+01 =	1.03e+02 -	1.06e+02 -	2.78e+02 -	1.63e+02 -	3.93e+03 -
WCCI20-MaTSO2-T19	4.77e+01	6.11e+01 -	5.13e+01 =	3.91e+02 -	1.89e+02 =	6.31e+01 -	2.34e+03 -
WCCI20-MaTSO2-T20	4.82e+01	4.86e+01 =	1.16e+02 =	1.26e+02 -	1.19e+02 =	1.30e+02 -	6.49e+03 -
WCCI20-MaTSO2-T21	5.41e+01	8.72e+01 -	1.10e+02 -	3.36e+02 -	1.32e+02 -	1.11e+02 -	4.54e+03 -
WCCI20-MaTSO2-T22	4.72e+01	4.75e+01 =	1.91e+02 -	1.82e+02 -	2.81e+02 -	1.31e+02 -	4.50e+03 -
WCCI20-MaTSO2-T23	4.82e+01	1.04e+02 -	7.30e+01 -	3.63e+02 -	3.63e+02 =	1.11e+02 -	3.17e+03 -
WCCI20-MaTSO2-T24	4.78e+01	4.77e+01 =	7.49e+01 =	7.43e+01 -	1.02e+02 -	8.04e+01 -	4.27e+03 -
WCCI20-MaTSO2-T25	4.76e+01	9.69e+01 -	9.66e+01 -	1.79e+02 -	2.92e+02 -	1.17e+02 -	2.21e+03 -
WCCI20-MaTSO2-T26	4.77e+01	4.74e+01 =	5.72e+01 -	8.58e+01 -	1.05e+02 =	9.50e+01 -	4.52e+03 -
WCCI20-MaTSO2-T27	5.75e+01	1.28e+02 -	1.08e+02 =	3.20e+02 -	1.63e+02 -	1.18e+02 -	2.87e+03 -
WCCI20-MaTSO2-T28	5.14e+01	4.83e+01 =	8.66e+01 =	3.02e+02 -	1.77e+02 =	8.15e+01 -	3.11e+03 -
WCCI20-MaTSO2-T29	4.76e+01	8.90e+01 -	7.24e+01 -	1.17e+02 -	2.30e+02 -	6.29e+01 -	5.10e+03 -
WCCI20-MaTSO2-T30	5.73e+01	5.80e+01 =	1.77e+02 -	7.64e+02 -	3.99e+02 -	3.15e+02 -	4.45e+03 -
WCCI20-MaTSO2-T31	5.00e+01	1.15e+02 -	8.92e+01 -	4.37e+02 -	2.50e+02 -	1.16e+02 -	3.05e+03 -
WCCI20-MaTSO2-T32	5.05e+01	5.37e+01 =	1.26e+02 -	6.41e+02 -	1.11e+02 -	1.47e+02 -	6.64e+03 -
WCCI20-MaTSO2-T33	4.77e+01	7.78e+01 -	4.89e+01 -	3.38e+02 -	1.28e+02 -	9.35e+01 -	2.10e+03 -
WCCI20-MaTSO2-T34	4.78e+01	4.77e+01 =	6.73e+01 -	8.16e+01 -	3.37e+02 -	7.22e+01 -	2.54e+03 -
WCCI20-MaTSO2-T35	4.78e+01	7.51e+01 -	9.37e+01 -	8.56e+01 =	2.15e+02 -	9.11e+01 -	1.83e+03 -
WCCI20-MaTSO2-T36	4.74e+01	5.11e+01 -	1.35e+02 -	1.36e+02 -	2.38e+02 -	1.25e+02 -	3.13e+03 -
WCCI20-MaTSO2-T37	4.78e+01	6.27e+01 -	7.82e+01 -	1.67e+02 -	1.13e+02 -	7.08e+01 -	2.31e+03 -
WCCI20-MaTSO2-T38	5.89e+01	5.49e+01 =	9.22e+01 =	1.90e+02 -	1.15e+02 -	1.85e+02 -	3.32e+03 -
WCCI20-MaTSO2-T39	5.40e+01	3.58e+02 -	2.86e+02 -	3.01e+02 -	5.45e+02 =	3.60e+02 -	6.07e+03 -
WCCI20-MaTSO2-T40	5.36e+01	4.77e+01 =	1.11e+02 -	1.44e+02 -	3.20e+02 -	1.37e+02 -	3.33e+03 -
WCCI20-MaTSO2-T41	1.15e+02	2.70e+02 -	1.61e+02 =	2.30e+02 =	2.13e+02 =	2.57e+02 -	3.97e+03 -
WCCI20-MaTSO2-T42	4.77e+01	4.82e+01 =	6.31e+01 =	4.74e+02 -	4.37e+02 -	1.41e+02 -	2.52e+03 -
WCCI20-MaTSO2-T43	4.79e+01	6.22e+01 -	7.68e+01 -	2.75e+02 =	9.61e+01 -	6.77e+01 -	2.55e+03 -
WCCI20-MaTSO2-T44	5.39e+01	5.71e+01 =	7.62e+01 -	3.62e+02 -	2.98e+02 -	6.35e+01 -	1.83e+03 -
WCCI20-MaTSO2-T45	5.71e+01	1.44e+02 -	1.27e+02 -	3.19e+02 -	2.94e+02 -	9.79e+01 -	2.09e+03 -
WCCI20-MaTSO2-T46	5.70e+01	5.58e+01 =	8.71e+01 -	5.75e+02 -	3.74e+02 -	8.94e+01 -	6.63e+03 -
WCCI20-MaTSO2-T47	8.53e+01	2.14e+02 -	1.44e+02 -	7.67e+02 =	1.10e+02 =	2.89e+02 -	3.79e+03 -
WCCI20-MaTSO2-T48	5.07e+01	5.04e+01 =	1.66e+02 -	4.06e+02 -	3.84e+02 -	2.53e+02 -	3.28e+03 -
WCCI20-MaTSO2-T49	4.75e+01	8.88e+01 -	6.24e+01 =	2.72e+02 -	2.06e+02 -	1.06e+02 -	1.74e+03 -
WCCI20-MaTSO2-T50	5.06e+01	4.75e+01 =	7.03e+01 -	2.16e+02 -	1.36e+02 =	1.27e+02 -	1.51e+03 -
+/-/=	Base	1/29/20	0/36/14	0/44/6	0/38/12	0/50/0	0/50/0

Table 9: The comparison results of MTEA-ATS with other six algorithms on WCCI20-MaTSO3 problem

	MTEA-ATS	KR-MTEA	BoKTDE	MTEA-SaO	AEMTO	MaTDE	DE
WCCI20-MaTSO3-T1	3.52e+02	1.52e+02 +	3.39e+02 +	1.74e+02 +	2.06e+02 +	2.75e+02 +	4.63e+02 -
WCCI20-MaTSO3-T2	3.52e+02	3.57e+02 =	3.38e+02 +	2.07e+02 +	2.30e+02 +	2.73e+02 +	4.58e+02 -
WCCI20-MaTSO3-T3	3.48e+02	1.65e+02 +	3.42e+02 =	1.94e+02 +	2.41e+02 +	2.87e+02 +	4.62e+02 -
WCCI20-MaTSO3-T4	3.51e+02	3.37e+02 =	3.44e+02 =	1.61e+02 +	2.21e+02 +	2.76e+02 +	4.67e+02 -
WCCI20-MaTSO3-T5	3.48e+02	1.47e+02 +	3.38e+02 =	1.58e+02 +	2.32e+02 +	2.59e+02 +	4.62e+02 -
WCCI20-MaTSO3-T6	3.53e+02	3.59e+02 =	3.40e+02 +	1.82e+02 +	2.38e+02 +	2.69e+02 +	4.67e+02 -
WCCI20-MaTSO3-T7	3.50e+02	1.52e+02 +	3.41e+02 +	1.85e+02 +	1.98e+02 +	2.87e+02 +	4.61e+02 -
WCCI20-MaTSO3-T8	3.45e+02	3.55e+02 -	3.40e+02 =	1.85e+02 +	2.30e+02 +	2.32e+02 +	4.66e+02 -
WCCI20-MaTSO3-T9	3.50e+02	1.47e+02 +	3.39e+02 +	1.73e+02 +	1.92e+02 +	2.77e+02 +	4.62e+02 -
WCCI20-MaTSO3-T10	3.49e+02	3.54e+02 =	3.38e+02 +	1.83e+02 +	1.93e+02 +	2.66e+02 +	4.58e+02 -
WCCI20-MaTSO3-T11	3.49e+02	1.40e+02 +	3.38e+02 +	1.67e+02 +	2.01e+02 +	2.77e+02 +	4.63e+02 -
WCCI20-MaTSO3-T12	3.49e+02	3.43e+02 =	3.45e+02 =	1.97e+02 +	2.60e+02 +	2.80e+02 +	4.60e+02 -
WCCI20-MaTSO3-T13	3.53e+02	1.32e+02 +	3.47e+02 +	1.80e+02 +	2.13e+02 +	2.87e+02 +	4.55e+02 -
WCCI20-MaTSO3-T14	3.54e+02	3.54e+02 =	3.43e+02 +	1.89e+02 +	2.02e+02 +	2.77e+02 +	4.54e+02 -
WCCI20-MaTSO3-T15	3.48e+02	1.40e+02 +	3.43e+02 =	1.93e+02 +	2.54e+02 +	2.85e+02 +	4.57e+02 -
WCCI20-MaTSO3-T16	3.52e+02	3.54e+02 =	3.43e+02 =	1.89e+02 +	1.71e+02 +	3.03e+02 +	4.64e+02 -
WCCI20-MaTSO3-T17	3.55e+02	1.34e+02 +	3.40e+02 +	1.70e+02 +	2.22e+02 +	2.72e+02 +	4.62e+02 -
WCCI20-MaTSO3-T18	3.48e+02	3.46e+02 =	3.41e+02 =	1.97e+02 +	2.44e+02 +	2.63e+02 +	4.62e+02 -
WCCI20-MaTSO3-T19	3.47e+02	1.55e+02 +	3.42e+02 =	2.03e+02 +	1.87e+02 +	2.75e+02 +	4.61e+02 -
WCCI20-MaTSO3-T20	3.49e+02	3.57e+02 =	3.43e+02 =	1.92e+02 +	2.04e+02 +	2.74e+02 +	4.55e+02 -
WCCI20-MaTSO3-T21	3.54e+02	1.56e+02 +	3.40e+02 +	1.75e+02 +	2.55e+02 +	2.60e+02 +	4.57e+02 -
WCCI20-MaTSO3-T22	3.55e+02	3.40e+02 =	3.43e+02 +	1.73e+02 +	1.93e+02 +	2.81e+02 +	4.54e+02 -
WCCI20-MaTSO3-T23	3.50e+02	1.42e+02 +	3.37e+02 +	2.01e+02 +	2.35e+02 +	2.61e+02 +	4.56e+02 -
WCCI20-MaTSO3-T24	3.55e+02	3.57e+02 =	3.38e+02 +	1.80e+02 +	2.18e+02 +	2.64e+02 +	4.55e+02 -
WCCI20-MaTSO3-T25	3.55e+02	1.71e+02 +	3.37e+02 +	1.80e+02 +	2.41e+02 +	2.58e+02 +	4.64e+02 -
WCCI20-MaTSO3-T26	3.44e+02	3.54e+02 =	3.42e+02 =	1.71e+02 +	2.68e+02 +	2.94e+02 +	4.62e+02 -
WCCI20-MaTSO3-T27	3.54e+02	1.38e+02 +	3.41e+02 +	1.84e+02 +	2.17e+02 +	3.12e+02 +	4.59e+02 -
WCCI20-MaTSO3-T28	3.49e+02	3.53e+02 =	3.46e+02 =	2.03e+02 +	2.26e+02 +	2.88e+02 +	4.62e+02 -
WCCI20-MaTSO3-T29	3.51e+02	1.62e+02 +	3.44e+02 =	1.71e+02 +	2.52e+02 +	2.76e+02 +	4.62e+02 -
WCCI20-MaTSO3-T30	3.42e+02	3.39e+02 =	3.43e+02 =	1.89e+02 +	2.17e+02 +	2.60e+02 +	4.59e+02 -
WCCI20-MaTSO3-T31	3.46e+02	1.46e+02 +	3.40e+02 =	1.94e+02 +	2.53e+02 +	2.33e+02 +	4.50e+02 -
WCCI20-MaTSO3-T32	3.49e+02	3.55e+02 =	3.37e+02 +	1.79e+02 +	2.17e+02 +	2.70e+02 +	4.61e+02 -
WCCI20-MaTSO3-T33	3.50e+02	1.33e+02 +	3.47e+02 +	1.87e+02 +	2.20e+02 +	2.74e+02 +	4.57e+02 -
WCCI20-MaTSO3-T34	3.49e+02	3.49e+02 =	3.42e+02 =	1.80e+02 +	2.11e+02 +	2.47e+02 +	4.62e+02 -
WCCI20-MaTSO3-T35	3.50e+02	1.50e+02 +	3.39e+02 +	1.74e+02 +	2.31e+02 +	2.80e+02 +	4.62e+02 -
WCCI20-MaTSO3-T36	3.48e+02	3.58e+02 -	3.35e+02 +	1.84e+02 +	1.93e+02 +	2.78e+02 +	4.60e+02 -
WCCI20-MaTSO3-T37	3.46e+02	1.47e+02 +	3.41e+02 =	1.76e+02 +	2.18e+02 +	2.83e+02 +	4.57e+02 -
WCCI20-MaTSO3-T38	3.54e+02	3.51e+02 =	3.40e+02 +	1.72e+02 +	2.23e+02 +	2.87e+02 +	4.61e+02 -
WCCI20-MaTSO3-T39	3.50e+02	1.43e+02 +	3.37e+02 +	1.78e+02 +	1.81e+02 +	2.83e+02 +	4.54e+02 -
WCCI20-MaTSO3-T40	3.52e+02	3.51e+02 =	3.43e+02 +	1.82e+02 +	2.34e+02 +	2.89e+02 +	4.58e+02 -
WCCI20-MaTSO3-T41	3.49e+02	1.48e+02 +	3.37e+02 +	1.79e+02 +	2.39e+02 +	2.62e+02 +	4.63e+02 -
WCCI20-MaTSO3-T42	3.51e+02	3.54e+02 =	3.41e+02 +	2.08e+02 +	2.22e+02 +	2.67e+02 +	4.52e+02 -
WCCI20-MaTSO3-T43	3.49e+02	1.37e+02 +	3.44e+02 =	1.75e+02 +	2.12e+02 +	2.88e+02 +	4.58e+02 -
WCCI20-MaTSO3-T44	3.49e+02	3.52e+02 =	3.36e+02 +	1.70e+02 +	2.11e+02 +	2.85e+02 +	4.69e+02 -
WCCI20-MaTSO3-T45	3.50e+02	1.51e+02 +	3.47e+02 +	1.72e+02 +	2.16e+02 +	2.74e+02 +	4.66e+02 -
WCCI20-MaTSO3-T46	3.52e+02	3.43e+02 =	3.41e+02 +	1.88e+02 +	2.16e+02 +	2.61e+02 +	4.60e+02 -
WCCI20-MaTSO3-T47	3.50e+02	1.43e+02 +	3.41e+02 +	1.74e+02 +	1.90e+02 +	2.66e+02 +	4.58e+02 -
WCCI20-MaTSO3-T48	3.48e+02	3.55e+02 =	3.45e+02 =	1.85e+02 +	2.56e+02 +	2.72e+02 +	4.58e+02 -
WCCI20-MaTSO3-T49	3.47e+02	1.65e+02 +	3.43e+02 =	1.94e+02 +	2.21e+02 +	2.57e+02 +	4.62e+02 -
WCCI20-MaTSO3-T50	3.51e+02	3.59e+02 =	3.44e+02 =	1.68e+02 +	2.25e+02 +	2.70e+02 +	4.56e+02 -
+/-/=	Base	26/2/22	28/0/22	50/0/0	50/0/0	50/0/0	0/50/0

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Table 10: The comparison results of MTEA-ATS with other six algorithms on WCCI20-MaTSO4 problem

	MTEA-ATS	KR-MTEA	BoKTDE	MTEA-SaO	AEMTO	MaTDE	DE
WCCI20-MaTSO4-T1	0.00e+00	3.18e-02 -	0.00e+00 =	2.61e-04 -	6.66e-02 -	4.98e-06 -	2.96e-02 -
WCCI20-MaTSO4-T2	4.78e+01	5.12e+01 =	2.43e+02 -	2.01e+02 -	2.23e+02 -	1.15e+02 -	2.21e+03 -
WCCI20-MaTSO4-T3	3.98e-09	2.05e+00 -	0.00e+00 =	1.25e-02 -	1.19e-01 -	2.74e+00 -	2.11e+01 -
WCCI20-MaTSO4-T4	0.00e+00	5.06e-08 =	0.00e+00 =	2.88e-04 -	1.84e-02 -	4.98e-06 -	2.76e-02 -
WCCI20-MaTSO4-T5	4.75e+01	1.30e+02 -	2.45e+03 -	1.50e+02 -	1.66e+02 -	1.54e+02 -	1.73e+03 -
WCCI20-MaTSO4-T6	2.10e-09	4.67e-05 -	8.58e-05 =	1.39e-02 -	3.87e-01 -	2.65e+00 -	2.11e+01 -
WCCI20-MaTSO4-T7	0.00e+00	2.65e-02 -	0.00e+00 =	2.33e-04 -	6.62e-02 -	5.92e-06 -	2.75e-02 -
WCCI20-MaTSO4-T8	5.09e+01	5.10e+01 -	1.31e+03 -	1.43e+02 -	4.13e+02 -	2.13e+02 -	1.15e+03 -
WCCI20-MaTSO4-T9	1.69e-09	1.95e+00 -	2.74e-04 =	1.21e-02 -	1.94e-01 -	2.67e+00 -	2.12e+01 -
WCCI20-MaTSO4-T10	0.00e+00	2.30e-09 =	0.00e+00 =	2.46e-04 -	5.05e-03 -	4.92e-06 -	2.99e-02 -
WCCI20-MaTSO4-T11	5.11e+01	1.09e+02 -	7.75e+02 -	2.66e+02 -	1.32e+02 -	1.62e+02 -	3.00e+03 -
WCCI20-MaTSO4-T12	0.00e+00	1.83e-05 -	1.73e-06 =	1.34e-02 -	1.07e-01 -	2.57e+00 -	2.11e+01 -
WCCI20-MaTSO4-T13	0.00e+00	2.52e-02 -	0.00e+00 =	3.16e-04 -	9.79e-04 =	4.81e-06 -	3.06e-02 -
WCCI20-MaTSO4-T14	9.27e+01	1.45e+02 =	4.48e+02 -	2.40e+02 -	3.33e+02 -	4.44e+02 -	3.98e+03 -
WCCI20-MaTSO4-T15	1.88e-09	2.12e+00 -	0.00e+00 =	1.12e-02 -	2.84e-01 -	2.54e+00 -	2.11e+01 -
WCCI20-MaTSO4-T16	0.00e+00	2.97e-08 -	0.00e+00 =	3.29e-04 -	7.80e-02 -	5.96e-06 -	2.93e-02 -
WCCI20-MaTSO4-T17	9.35e+01	3.30e+02 -	3.68e+02 -	4.16e+02 =	4.35e+02 -	2.35e+02 -	2.57e+03 -
WCCI20-MaTSO4-T18	1.94e-09	4.25e-05 -	8.39e-08 -	1.13e-02 -	1.63e-01 -	2.68e+00 -	2.12e+01 -
WCCI20-MaTSO4-T19	0.00e+00	2.47e-02 -	0.00e+00 =	2.93e-04 -	2.50e-03 -	5.14e-06 -	2.98e-02 -
WCCI20-MaTSO4-T20	4.75e+01	4.78e+01 -	1.00e+03 -	2.80e+02 -	1.14e+02 -	1.44e+02 -	3.48e+03 -
WCCI20-MaTSO4-T21	0.00e+00	2.10e+00 -	0.00e+00 =	1.44e-02 -	2.94e-01 -	2.70e+00 -	2.11e+01 -
WCCI20-MaTSO4-T22	0.00e+00	2.05e-08 =	0.00e+00 =	2.73e-04 -	3.69e-02 -	4.00e-06 -	3.19e-02 -
WCCI20-MaTSO4-T23	9.41e+01	3.34e+02 -	3.91e+02 -	4.61e+02 -	7.33e+02 -	2.48e+02 -	5.12e+03 -
WCCI20-MaTSO4-T24	0.00e+00	1.58e-05 -	9.34e-06 =	1.22e-02 -	1.72e-01 -	2.67e+00 -	2.11e+01 -
WCCI20-MaTSO4-T25	0.00e+00	2.66e-02 -	0.00e+00 =	2.40e-04 -	2.31e-01 -	5.26e-06 -	3.14e-02 -
WCCI20-MaTSO4-T26	5.18e+01	6.57e+01 =	5.22e+02 -	2.70e+02 -	1.54e+02 -	1.37e+02 -	1.59e+03 -
WCCI20-MaTSO4-T27	3.93e-09	1.82e+00 -	0.00e+00 +	1.33e-02 -	1.56e-01 -	2.75e+00 -	2.12e+01 -
WCCI20-MaTSO4-T28	0.00e+00	5.75e-09 -	0.00e+00 =	2.24e-04 -	2.07e-03 =	4.94e-06 -	3.10e-02 -
WCCI20-MaTSO4-T29	1.47e+02	4.08e+02 -	4.59e+02 -	1.19e+03 -	4.07e+02 =	3.69e+02 -	1.68e+03 -
WCCI20-MaTSO4-T30	1.12e-08	1.46e-05 -	5.69e-05 =	1.30e-02 -	1.23e-01 -	2.54e+00 -	2.12e+01 -
WCCI20-MaTSO4-T31	0.00e+00	2.61e-02 -	0.00e+00 =	2.77e-04 -	7.53e-02 =	5.33e-06 -	3.01e-02 -
WCCI20-MaTSO4-T32	1.92e+02	3.12e+02 -	8.34e+02 -	7.15e+02 -	1.03e+03 -	7.77e+02 -	2.51e+03 -
WCCI20-MaTSO4-T33	3.93e-08	2.08e+00 -	0.00e+00 +	1.01e-02 -	7.58e-02 -	2.54e+00 -	2.11e+01 -
WCCI20-MaTSO4-T34	0.00e+00	0.00e+00 =	0.00e+00 =	2.55e-04 -	3.26e-05 =	6.75e-06 -	3.11e-02 -
WCCI20-MaTSO4-T35	3.71e+02	1.36e+03 -	3.66e+02 +	4.12e+02 =	6.54e+02 -	1.14e+03 -	3.66e+03 -
WCCI20-MaTSO4-T36	3.57e-09	1.16e-05 -	2.85e-05 =	1.07e-02 -	6.00e-02 -	2.60e+00 -	2.12e+01 -
WCCI20-MaTSO4-T37	0.00e+00	2.26e-02 -	0.00e+00 =	2.62e-04 -	8.40e-05 -	6.69e-06 -	2.71e-02 -
WCCI20-MaTSO4-T38	2.27e+02	1.43e+02 =	5.17e+02 -	6.95e+02 =	6.13e+02 -	1.21e+03 -	4.24e+03 -
WCCI20-MaTSO4-T39	2.38e-09	2.09e+00 -	0.00e+00 =	1.24e-02 -	2.77e-01 -	2.40e+00 -	2.11e+01 -
WCCI20-MaTSO4-T40	0.00e+00	1.61e-07 -	0.00e+00 =	3.05e-04 -	4.36e-02 -	5.71e-06 -	3.02e-02 -
WCCI20-MaTSO4-T41	5.41e+01	2.07e+02 -	5.57e+02 -	2.07e+02 -	1.97e+02 -	2.34e+02 -	3.37e+03 -
WCCI20-MaTSO4-T42	8.23e-10	3.25e-05 -	0.00e+00 =	1.14e-02 -	8.07e-02 -	2.60e+00 -	2.11e+01 -
WCCI20-MaTSO4-T43	0.00e+00	2.18e-02 -	0.00e+00 =	2.78e-04 -	7.12e-03 -	8.45e-06 -	2.83e-02 -
WCCI20-MaTSO4-T44	5.93e+01	5.31e+01 +	2.53e+03 -	9.69e+01 -	2.60e+02 -	1.61e+02 -	2.21e+03 -
WCCI20-MaTSO4-T45	0.00e+00	1.89e+00 -	7.60e-08 =	1.29e-02 -	1.34e-01 -	2.50e+00 -	2.11e+01 -
WCCI20-MaTSO4-T46	0.00e+00	2.42e-07 =	0.00e+00 =	2.33e-04 -	3.81e-01 -	5.66e-06 -	3.08e-02 -
WCCI20-MaTSO4-T47	5.10e+01	1.58e+02 -	2.95e+03 -	9.68e+01 -	1.03e+02 -	1.12e+02 -	1.81e+03 -
WCCI20-MaTSO4-T48	0.00e+00	1.07e-05 -	0.00e+00 =	1.14e-02 -	8.30e-04 -	2.57e+00 -	2.12e+01 -
WCCI20-MaTSO4-T49	0.00e+00	3.10e-02 -	0.00e+00 =	2.76e-04 -	1.07e-01 -	5.88e-06 -	2.79e-02 -
WCCI20-MaTSO4-T50	1.60e+02	9.61e+01 =	8.10e+02 -	7.20e+02 =	9.03e+02 -	6.21e+02 -	3.40e+03 -
+/-/=	Base	1/39/10	3/16/31	0/46/4	0/45/5	0/50/0	0/50/0

Table 11: The comparison results of MTEA-ATS with other six algorithms on WCCI20-MaTSO5 problem

	MTEA-ATS	KR-MTEA	BoKTDE	MTEA-SaO	AEMTO	MaTDE	DE
WCCI20-MaTSO5-T1	3.72e+02	1.61e+02 +	2.21e+02 +	1.71e+02 +	2.41e+02 +	3.57e+02 =	4.57e+02 -
WCCI20-MaTSO5-T2	7.31e-10	4.06e-08 -	7.96e-06 -	2.36e-03 -	1.89e-02 -	7.04e-03 -	3.51e-01 -
WCCI20-MaTSO5-T3	2.17e-01	1.47e+01 -	1.82e+00 -	2.64e+01 -	5.28e+00 -	1.54e+01 -	6.75e+01 -
WCCI20-MaTSO5-T4	3.71e+02	3.55e+02 +	2.80e+02 +	2.19e+02 +	2.40e+02 +	3.35e+02 +	4.58e+02 -
WCCI20-MaTSO5-T5	0.00e+00	2.66e-02 -	8.70e-06 -	1.16e-03 -	2.50e-03 -	7.17e-03 -	3.60e-01 -
WCCI20-MaTSO5-T6	2.08e-01	4.95e-01 -	1.63e+00 -	2.88e+01 -	8.14e+00 -	1.48e+01 -	6.73e+01 -
WCCI20-MaTSO5-T7	3.64e+02	1.41e+02 +	2.98e+02 +	2.13e+02 +	2.19e+02 +	3.30e+02 =	4.55e+02 -
WCCI20-MaTSO5-T8	5.35e-09	3.70e-04 -	2.20e-05 -	8.71e-04 -	8.27e-03 -	1.48e-02 -	3.63e-01 -
WCCI20-MaTSO5-T9	1.43e-01	1.41e+01 -	1.46e+00 -	2.92e+01 -	6.05e+00 -	1.61e+01 -	6.71e+01 -
WCCI20-MaTSO5-T10	3.75e+02	3.53e+02 +	2.69e+02 +	2.32e+02 +	2.21e+02 +	3.55e+02 =	4.64e+02 -
WCCI20-MaTSO5-T11	0.00e+00	2.41e-02 -	3.83e-05 -	1.23e-03 -	5.75e-03 -	5.09e-03 -	3.65e-01 -
WCCI20-MaTSO5-T12	1.57e-01	6.60e-01 -	1.45e+00 -	2.97e+01 -	6.71e+00 -	1.57e+01 -	6.75e+01 -
WCCI20-MaTSO5-T13	3.69e+02	1.54e+02 +	2.87e+02 +	2.06e+02 +	2.62e+02 +	3.60e+02 =	4.61e+02 -
WCCI20-MaTSO5-T14	0.00e+00	1.29e-07 -	1.36e-05 -	1.09e-03 -	3.64e-02 -	6.69e-03 -	3.60e-01 -
WCCI20-MaTSO5-T15	2.28e-01	1.45e+01 -	2.29e+00 -	2.20e+01 -	7.44e+00 -	1.62e+01 -	6.75e+01 -
WCCI20-MaTSO5-T16	3.70e+02	3.55e+02 +	2.56e+02 +	2.18e+02 +	2.34e+02 +	3.32e+02 +	4.55e+02 -
WCCI20-MaTSO5-T17	1.43e-09	2.87e-02 -	3.26e-05 -	1.29e-03 -	2.49e-03 -	5.91e-03 -	3.62e-01 -
WCCI20-MaTSO5-T18	2.46e-01	7.96e-01 -	1.60e+00 -	2.77e+01 -	5.57e+00 -	1.52e+01 -	6.70e+01 -
WCCI20-MaTSO5-T19	3.70e+02	1.57e+02 +	2.56e+02 +	2.17e+02 +	2.24e+02 +	3.54e+02 =	4.62e+02 -
WCCI20-MaTSO5-T20	7.59e-09	6.82e-08 -	8.89e-06 -	1.96e-03 -	4.02e-02 -	7.43e-03 -	3.39e-01 -
WCCI20-MaTSO5-T21	3.30e-01	1.58e+01 -	1.70e+00 -	2.47e+01 -	6.79e+00 -	1.56e+01 -	6.79e+01 -
WCCI20-MaTSO5-T22	3.64e+02	3.41e+02 +	2.51e+02 +	2.29e+02 +	2.40e+02 +	3.37e+02 +	4.53e+02 -
WCCI20-MaTSO5-T23	2.75e-09	2.55e-02 -	4.34e-05 -	1.32e-03 -	8.08e-03 -	9.05e-03 -	3.59e-01 -
WCCI20-MaTSO5-T24	3.71e-01	1.05e+00 -	2.57e+00 -	2.89e+01 -	7.44e+00 -	1.74e+01 -	6.78e+01 -
WCCI20-MaTSO5-T25	3.67e+02	1.57e+02 +	2.55e+02 +	2.18e+02 +	2.27e+02 +	3.47e+02 =	4.50e+02 -
WCCI20-MaTSO5-T26	1.41e-09	3.48e-08 -	3.25e-05 -	7.39e-04 -	1.62e-02 -	9.47e-03 -	3.64e-01 -
WCCI20-MaTSO5-T27	7.86e-02	1.65e+01 -	3.31e+00 -	3.10e+01 -	8.39e+00 -	1.75e+01 -	6.79e+01 -
WCCI20-MaTSO5-T28	3.71e+02	3.50e+02 +	2.77e+02 +	2.19e+02 +	2.49e+02 +	3.25e+02 +	4.66e+02 -
WCCI20-MaTSO5-T29	2.44e-09	2.84e-02 -	1.97e-05 -	2.08e-03 -	3.36e-03 -	8.39e-03 -	3.63e-01 -
WCCI20-MaTSO5-T30	1.30e-01	8.85e-01 -	2.13e+00 -	2.82e+01 -	5.74e+00 -	1.73e+01 -	6.75e+01 -
WCCI20-MaTSO5-T31	3.67e+02	1.59e+02 +	2.07e+02 +	2.24e+02 +	2.55e+02 +	3.51e+02 =	4.64e+02 -
WCCI20-MaTSO5-T32	0.00e+00	1.05e-07 -	1.88e-05 -	2.65e-03 -	5.91e-03 -	5.19e-03 -	3.48e-01 -
WCCI20-MaTSO5-T33	2.19e-01	1.58e+01 -	1.86e+00 -	2.80e+01 -	6.13e+00 -	1.70e+01 -	6.76e+01 -
WCCI20-MaTSO5-T34	3.67e+02	3.62e+02 =	2.45e+02 +	2.02e+02 +	2.10e+02 +	3.45e+02 =	4.61e+02 -
WCCI20-MaTSO5-T35	4.06e-09	2.40e-02 -	4.34e-04 -	1.79e-03 -	2.30e-03 -	9.50e-03 -	3.46e-01 -
WCCI20-MaTSO5-T36	2.29e-01	7.05e-01 -	1.60e+00 -	3.17e+01 -	4.85e+00 -	1.40e+01 -	6.75e+01 -
WCCI20-MaTSO5-T37	3.69e+02	1.47e+02 +	3.06e+02 +	2.17e+02 +	2.19e+02 +	3.39e+02 =	4.60e+02 -
WCCI20-MaTSO5-T38	0.00e+00	1.19e-07 -	8.45e-06 -	2.15e-03 -	2.20e-02 -	6.67e-03 -	3.45e-01 -
WCCI20-MaTSO5-T39	3.48e-01	1.70e+01 -	2.59e+00 -	2.71e+01 -	6.17e+00 -	1.76e+01 -	6.74e+01 -
WCCI20-MaTSO5-T40	3.68e+02	3.58e+02 +	2.69e+02 +	1.94e+02 +	2.58e+02 +	3.41e+02 +	4.58e+02 -
WCCI20-MaTSO5-T41	0.00e+00	2.36e-02 -	1.08e-04 -	6.59e-04 -	2.55e-03 -	6.14e-03 -	3.49e-01 -
WCCI20-MaTSO5-T42	9.29e-02	5.25e-01 -	1.78e+00 -	2.45e+01 -	6.32e+00 -	1.51e+01 -	6.67e+01 -
WCCI20-MaTSO5-T43	3.69e+02	1.43e+02 +	2.71e+02 +	2.20e+02 +	2.53e+02 +	3.40e+02 +	4.64e+02 -
WCCI20-MaTSO5-T44	2.04e-08	3.70e-04 -	2.25e-05 -	1.59e-03 -	5.10e-03 -	9.19e-03 -	3.67e-01 -
WCCI20-MaTSO5-T45	1.32e-01	1.41e+01 -	2.06e+00 -	2.83e+01 -	6.79e+00 -	1.56e+01 -	6.70e+01 -
WCCI20-MaTSO5-T46	3.72e+02	3.54e+02 +	2.66e+02 +	1.95e+02 +	2.26e+02 +	3.46e+02 =	4.62e+02 -
WCCI20-MaTSO5-T47	5.37e-10	2.20e-02 -	4.84e-05 -	3.27e-03 -	4.32e-03 -	1.05e-02 -	3.53e-01 -
WCCI20-MaTSO5-T48	1.35e-01	8.17e-01 -	1.47e+00 -	2.91e+01 -	5.36e+00 -	1.55e+01 -	6.76e+01 -
WCCI20-MaTSO5-T49	3.71e+02	1.39e+02 +	3.09e+02 +	2.08e+02 +	2.24e+02 +	3.50e+02 =	4.60e+02 -
WCCI20-MaTSO5-T50	0.00e+00	3.12e-07 -	1.47e-05 -	2.71e-04 -	1.26e-02 -	4.21e-03 -	3.67e-01 -
+/-/=	Base	16/33/1	17/33/0	17/33/0	17/33/0	6/33/11	0/50/0

Table 12: The comparison results of MTEA-ATS with other six algorithms on WCCI20-MaTSO6 problem

	MTEA-ATS	KR-MTEA	BoKTDE	MTEA-SaO	AEMTO	MaTDE	DE
WCCI20-MaTSO6-T1	1.02e+02	5.45e+02 -	2.64e+02 =	1.93e+02 =	2.75e+02 =	3.72e+02 -	1.90e+03 -
WCCI20-MaTSO6-T2	7.41e-06	1.11e-03 =	5.28e-06 =	1.68e-03 -	2.81e-03 -	7.38e-03 -	3.49e-01 -
WCCI20-MaTSO6-T3	1.40e+04	5.79e+03 +	1.33e+04 +	7.22e+03 +	1.38e+04 =	1.42e+04 =	1.30e+04 +
WCCI20-MaTSO6-T4	5.98e+01	5.65e+01 =	2.50e+02 -	3.05e+02 -	1.74e+02 -	1.64e+02 -	3.11e+03 -
WCCI20-MaTSO6-T5	3.97e-04	2.89e-02 -	7.23e-06 =	2.18e-03 -	6.46e-03 -	8.91e-03 -	3.71e-01 -
WCCI20-MaTSO6-T6	1.38e+04	1.44e+04 -	1.36e+04 +	7.22e+03 +	1.31e+04 =	1.40e+04 -	1.33e+04 +
WCCI20-MaTSO6-T7	5.46e+01	1.92e+02 -	5.66e+02 -	3.41e+02 -	1.93e+02 -	1.26e+02 -	7.19e+03 -
WCCI20-MaTSO6-T8	3.71e-04	9.75e-08 =	7.04e-06 +	1.58e-03 -	2.14e-02 -	7.51e-03 -	3.37e-01 -
WCCI20-MaTSO6-T9	1.41e+04	6.06e+03 +	1.32e+04 +	6.69e+03 +	1.33e+04 +	1.42e+04 =	1.31e+04 +
WCCI20-MaTSO6-T10	1.25e+02	9.19e+01 =	3.79e+02 -	1.88e+02 =	1.41e+02 =	4.87e+02 -	2.65e+03 -
WCCI20-MaTSO6-T11	1.12e-05	3.04e-02 -	9.66e-06 =	1.17e-03 -	5.65e-03 -	7.13e-03 -	3.55e-01 -
WCCI20-MaTSO6-T12	1.38e+04	1.43e+04 -	1.32e+04 +	7.43e+03 +	1.37e+04 =	1.42e+04 -	1.30e+04 +
WCCI20-MaTSO6-T13	5.13e+01	1.19e+02 -	1.67e+02 -	1.28e+02 -	1.23e+02 -	8.14e+01 -	2.97e+03 -
WCCI20-MaTSO6-T14	9.04e-04	4.18e-07 =	1.26e-05 =	7.39e-04 +	5.10e-03 -	5.37e-03 -	3.67e-01 -
WCCI20-MaTSO6-T15	1.41e+04	5.62e+03 +	1.36e+04 +	7.13e+03 +	1.34e+04 =	1.41e+04 =	1.30e+04 +
WCCI20-MaTSO6-T16	1.06e+02	6.23e+01 =	5.03e+02 -	6.22e+02 -	2.91e+02 -	8.72e+02 -	6.00e+03 -
WCCI20-MaTSO6-T17	3.75e-04	2.70e-02 -	1.78e-05 +	8.02e-04 -	7.35e-03 -	5.84e-03 -	3.53e-01 -
WCCI20-MaTSO6-T18	1.41e+04	1.42e+04 -	1.32e+04 +	6.97e+03 +	1.28e+04 +	1.40e+04 -	1.31e+04 +
WCCI20-MaTSO6-T19	4.80e+01	1.37e+02 -	1.15e+03 -	1.12e+02 -	6.65e+01 =	1.70e+02 -	1.73e+03 -
WCCI20-MaTSO6-T20	1.72e-04	3.70e-04 =	6.45e-06 =	4.23e-04 -	8.40e-03 -	8.81e-03 -	3.46e-01 -
WCCI20-MaTSO6-T21	1.39e+04	5.33e+03 +	1.36e+04 =	7.36e+03 +	1.36e+04 =	1.41e+04 -	1.31e+04 +
WCCI20-MaTSO6-T22	1.52e+02	9.99e+01 =	4.14e+02 -	8.63e+02 -	5.57e+02 -	5.03e+02 -	3.03e+03 -
WCCI20-MaTSO6-T23	3.81e-04	2.62e-02 -	3.74e-04 =	4.34e-04 =	1.57e-02 -	5.79e-03 -	3.44e-01 -
WCCI20-MaTSO6-T24	1.37e+04	1.41e+04 -	1.32e+04 =	7.02e+03 +	1.43e+04 -	1.41e+04 -	1.33e+04 +
WCCI20-MaTSO6-T25	8.22e+01	4.01e+02 -	5.41e+02 -	5.14e+02 -	3.04e+02 -	2.53e+02 -	4.51e+03 -
WCCI20-MaTSO6-T26	1.28e-04	3.71e-04 =	1.87e-05 =	2.59e-03 -	6.41e-03 -	8.15e-03 -	3.53e-01 -
WCCI20-MaTSO6-T27	1.35e+04	5.30e+03 +	1.34e+04 =	7.47e+03 +	1.34e+04 =	1.42e+04 -	1.29e+04 +
WCCI20-MaTSO6-T28	7.94e+01	5.87e+01 =	8.09e+02 -	2.37e+02 -	1.76e+02 -	1.56e+02 -	3.53e+03 -
WCCI20-MaTSO6-T29	2.29e-03	3.06e-02 -	9.58e-06 =	1.12e-03 +	1.04e-02 -	7.97e-03 -	3.61e-01 -
WCCI20-MaTSO6-T30	1.39e+04	1.42e+04 -	1.33e+04 +	6.96e+03 +	1.39e+04 =	1.38e+04 =	1.30e+04 +
WCCI20-MaTSO6-T31	1.29e+02	2.81e+02 -	3.35e+02 -	2.68e+02 -	4.87e+02 -	3.01e+02 -	4.73e+03 -
WCCI20-MaTSO6-T32	1.24e-03	4.93e-04 =	5.80e-06 =	4.83e-04 +	1.82e-02 -	1.17e-02 -	3.54e-01 -
WCCI20-MaTSO6-T33	1.39e+04	6.02e+03 +	1.37e+04 =	6.91e+03 +	1.39e+04 =	1.40e+04 -	1.30e+04 +
WCCI20-MaTSO6-T34	4.78e+01	4.82e+01 =	4.21e+02 -	1.01e+02 -	3.29e+02 -	1.35e+02 -	3.39e+03 -
WCCI20-MaTSO6-T35	1.54e-03	2.77e-02 -	6.13e-06 =	8.03e-04 +	7.38e-03 -	7.06e-03 -	3.54e-01 -
WCCI20-MaTSO6-T36	1.41e+04	1.44e+04 -	1.35e+04 +	7.09e+03 +	1.35e+04 =	1.42e+04 =	1.31e+04 +
WCCI20-MaTSO6-T37	6.88e+01	3.23e+02 -	2.59e+02 -	5.75e+02 -	1.22e+02 =	1.79e+02 -	5.93e+03 -
WCCI20-MaTSO6-T38	3.73e-04	1.56e-07 =	2.76e-06 =	2.97e-03 -	1.21e-02 -	6.16e-03 -	3.52e-01 -
WCCI20-MaTSO6-T39	1.40e+04	5.70e+03 +	1.37e+04 +	7.13e+03 +	1.41e+04 =	1.42e+04 =	1.33e+04 +
WCCI20-MaTSO6-T40	2.24e+02	9.84e+01 =	3.31e+02 -	1.79e+02 =	5.37e+02 -	8.51e+02 -	5.30e+03 -
WCCI20-MaTSO6-T41	7.52e-04	2.58e-02 -	1.77e-05 =	4.25e-04 +	9.09e-03 -	5.74e-03 -	3.61e-01 -
WCCI20-MaTSO6-T42	1.38e+04	1.41e+04 -	1.33e+04 +	7.29e+03 +	1.36e+04 =	1.42e+04 -	1.31e+04 +
WCCI20-MaTSO6-T43	1.72e+02	7.39e+02 -	4.45e+02 -	4.68e+02 -	5.98e+02 -	6.71e+02 -	6.00e+03 -
WCCI20-MaTSO6-T44	2.27e-06	3.69e-07 =	7.29e-06 =	1.47e-03 -	2.26e-03 -	5.87e-03 -	3.72e-01 -
WCCI20-MaTSO6-T45	1.40e+04	5.52e+03 +	1.32e+04 +	7.13e+03 +	1.39e+04 =	1.41e+04 =	1.30e+04 +
WCCI20-MaTSO6-T46	4.88e+02	3.18e+02 =	1.12e+03 -	5.65e+02 -	7.29e+02 -	1.68e+03 -	4.26e+03 -
WCCI20-MaTSO6-T47	7.40e-04	2.46e-02 -	4.94e-06 =	1.27e-03 -	8.57e-03 -	1.19e-02 -	3.63e-01 -
WCCI20-MaTSO6-T48	1.41e+04	1.44e+04 -	1.37e+04 +	7.41e+03 +	1.39e+04 =	1.42e+04 =	1.30e+04 +
WCCI20-MaTSO6-T49	1.35e+02	4.35e+02 -	5.30e+02 -	3.75e+02 -	1.77e+02 -	2.09e+02 -	3.52e+03 -
WCCI20-MaTSO6-T50	6.24e-04	1.42e-07 =	1.36e-05 =	1.26e-03 -	6.54e-02 -	1.10e-02 -	3.44e-01 -
+/-/=	Base	8/24/18	13/11/26	21/20/9	2/24/24	0/38/12	16/34/0

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Table 13: The comparison results of MTEA-ATS with other six algorithms on WCCI20-MaTSO7 problem

	MTEA-ATS	KR-MTEA	BoKTDE	MTEA-SaO	AEMTO	MaTDE	DE
WCCI20-MaTSO7-T1	0.00e+00	1.85e+00 -	1.38e-08 =	6.45e-01 -	3.52e-01 -	2.55e+00 -	2.12e+01 -
WCCI20-MaTSO7-T2	3.64e+02	3.58e+02 =	1.97e+02 +	1.84e+02 +	2.36e+02 +	3.33e+02 =	4.56e+02 -
WCCI20-MaTSO7-T3	2.12e-01	1.67e+01 -	2.10e+00 -	3.10e+01 -	8.68e+00 -	1.67e+01 -	6.77e+01 -
WCCI20-MaTSO7-T4	0.00e+00	5.56e-06 -	2.27e-04 -	4.93e-01 -	1.69e-01 -	2.59e+00 -	2.12e+01 -
WCCI20-MaTSO7-T5	3.69e+02	1.47e+02 +	2.37e+02 +	1.94e+02 +	2.17e+02 +	3.67e+02 =	4.59e+02 -
WCCI20-MaTSO7-T6	5.05e-01	1.22e+00 -	1.51e+00 -	2.80e+01 -	5.00e+00 -	1.50e+01 -	6.76e+01 -
WCCI20-MaTSO7-T7	0.00e+00	2.09e+00 -	1.96e-04 -	1.94e-01 -	1.25e-01 -	2.76e+00 -	2.11e+01 -
WCCI20-MaTSO7-T8	3.66e+02	3.22e+02 =	2.03e+02 +	2.08e+02 +	2.10e+02 +	3.27e+02 +	4.60e+02 -
WCCI20-MaTSO7-T9	5.24e-01	1.46e+01 -	1.34e+00 -	2.97e+01 -	7.09e+00 -	1.64e+01 -	6.72e+01 -
WCCI20-MaTSO7-T10	0.00e+00	2.48e-05 -	4.48e-05 -	3.87e-01 -	2.72e-01 -	2.66e+00 -	2.11e+01 -
WCCI20-MaTSO7-T11	3.69e+02	1.50e+02 +	1.76e+02 +	1.96e+02 +	2.57e+02 +	3.48e+02 =	4.56e+02 -
WCCI20-MaTSO7-T12	2.85e-01	8.26e-01 -	1.90e+00 -	3.18e+01 -	8.35e+00 -	1.60e+01 -	6.80e+01 -
WCCI20-MaTSO7-T13	7.50e-08	1.89e+00 -	2.98e-04 =	3.47e-01 -	1.34e-01 -	2.65e+00 -	2.11e+01 -
WCCI20-MaTSO7-T14	3.72e+02	3.48e+02 +	2.60e+02 +	1.84e+02 +	2.29e+02 +	3.51e+02 =	4.63e+02 -
WCCI20-MaTSO7-T15	2.80e-01	1.63e+01 -	1.92e+00 -	2.92e+01 -	8.32e+00 -	1.75e+01 -	6.73e+01 -
WCCI20-MaTSO7-T16	6.53e-10	1.58e-05 -	1.06e-04 -	2.28e-01 -	7.46e-02 -	2.47e+00 -	2.11e+01 -
WCCI20-MaTSO7-T17	3.67e+02	1.47e+02 +	2.03e+02 +	2.22e+02 +	2.41e+02 +	3.49e+02 =	4.62e+02 -
WCCI20-MaTSO7-T18	1.68e-01	8.73e-01 -	1.42e+00 -	3.33e+01 -	6.39e+00 -	1.60e+01 -	6.72e+01 -
WCCI20-MaTSO7-T19	0.00e+00	1.94e+00 -	0.00e+00 =	3.51e-01 -	1.93e-02 -	2.66e+00 -	2.11e+01 -
WCCI20-MaTSO7-T20	3.66e+02	3.46e+02 =	1.90e+02 +	2.06e+02 +	2.45e+02 +	3.55e+02 +	4.59e+02 -
WCCI20-MaTSO7-T21	4.68e-01	1.62e+01 -	1.89e+00 -	2.73e+01 -	6.64e+00 -	1.50e+01 -	6.74e+01 -
WCCI20-MaTSO7-T22	0.00e+00	1.91e-05 -	4.74e-05 =	1.93e-01 -	4.20e-01 -	2.70e+00 -	2.12e+01 -
WCCI20-MaTSO7-T23	3.71e+02	1.54e+02 +	2.56e+02 +	1.95e+02 +	2.65e+02 +	3.29e+02 +	4.61e+02 -
WCCI20-MaTSO7-T24	2.35e-01	1.07e+00 -	1.70e+00 -	3.21e+01 -	6.55e+00 -	1.63e+01 -	6.76e+01 -
WCCI20-MaTSO7-T25	0.00e+00	1.98e+00 -	2.02e-05 =	2.52e-01 -	1.92e-01 -	2.69e+00 -	2.11e+01 -
WCCI20-MaTSO7-T26	3.66e+02	3.48e+02 +	2.01e+02 +	2.06e+02 +	1.94e+02 +	3.55e+02 =	4.52e+02 -
WCCI20-MaTSO7-T27	1.51e-01	1.29e+01 -	1.44e+00 -	3.13e+01 -	8.83e+00 -	1.57e+01 -	6.68e+01 -
WCCI20-MaTSO7-T28	0.00e+00	9.95e-06 -	4.75e-06 =	2.53e-01 -	2.27e-01 -	2.65e+00 -	2.11e+01 -
WCCI20-MaTSO7-T29	3.71e+02	1.42e+02 +	2.33e+02 +	1.95e+02 +	2.62e+02 +	3.43e+02 =	4.64e+02 -
WCCI20-MaTSO7-T30	2.10e-01	1.27e+00 -	1.39e+00 -	3.34e+01 -	7.06e+00 -	1.72e+01 -	6.74e+01 -
WCCI20-MaTSO7-T31	0.00e+00	1.78e+00 -	5.76e-04 -	4.85e-01 -	2.93e-01 -	2.80e+00 -	2.11e+01 -
WCCI20-MaTSO7-T32	3.69e+02	3.57e+02 =	2.41e+02 +	2.01e+02 +	2.24e+02 +	3.22e+02 +	4.60e+02 -
WCCI20-MaTSO7-T33	2.68e-01	1.54e+01 -	1.58e+00 -	2.58e+01 -	6.47e+00 -	1.57e+01 -	6.69e+01 -
WCCI20-MaTSO7-T34	6.09e-08	1.14e-05 -	6.60e-05 -	2.25e-01 -	1.41e-01 -	2.65e+00 -	2.11e+01 -
WCCI20-MaTSO7-T35	3.65e+02	1.44e+02 +	1.38e+02 +	1.97e+02 +	2.22e+02 +	3.53e+02 =	4.59e+02 -
WCCI20-MaTSO7-T36	9.37e-01	1.47e+00 -	2.13e+00 -	3.28e+01 -	8.56e+00 -	1.49e+01 -	6.74e+01 -
WCCI20-MaTSO7-T37	2.55e-06	1.80e+00 -	9.39e-05 =	2.15e-01 -	2.63e-01 -	2.65e+00 -	2.12e+01 -
WCCI20-MaTSO7-T38	3.74e+02	3.48e+02 +	1.37e+02 +	1.98e+02 +	2.55e+02 +	3.43e+02 +	4.60e+02 -
WCCI20-MaTSO7-T39	3.41e-01	1.47e+01 -	1.54e+00 -	3.17e+01 -	4.94e+00 -	1.55e+01 -	6.65e+01 -
WCCI20-MaTSO7-T40	0.00e+00	1.11e-06 -	2.19e-05 -	8.76e-02 -	1.84e-01 -	2.68e+00 -	2.12e+01 -
WCCI20-MaTSO7-T41	3.72e+02	1.53e+02 +	2.00e+02 +	2.20e+02 +	2.36e+02 +	3.56e+02 =	4.62e+02 -
WCCI20-MaTSO7-T42	2.15e-01	1.40e+00 -	2.58e+00 -	2.96e+01 -	6.07e+00 -	1.74e+01 -	6.74e+01 -
WCCI20-MaTSO7-T43	0.00e+00	2.15e+00 -	1.66e-04 =	3.36e-01 -	1.36e-01 -	2.60e+00 -	2.11e+01 -
WCCI20-MaTSO7-T44	3.67e+02	3.54e+02 +	2.16e+02 +	1.92e+02 +	2.31e+02 +	3.53e+02 =	4.61e+02 -
WCCI20-MaTSO7-T45	3.78e-01	1.49e+01 -	1.77e+00 -	2.99e+01 -	4.99e+00 -	1.55e+01 -	6.70e+01 -
WCCI20-MaTSO7-T46	0.00e+00	1.96e-05 -	1.83e-07 =	4.31e-01 -	1.15e-01 -	2.77e+00 -	2.12e+01 -
WCCI20-MaTSO7-T47	3.70e+02	1.38e+02 +	2.04e+02 +	2.05e+02 +	2.26e+02 +	3.58e+02 =	4.53e+02 -
WCCI20-MaTSO7-T48	6.96e-02	7.17e-01 -	1.56e+00 -	3.11e+01 -	6.99e+00 -	1.62e+01 -	6.73e+01 -
WCCI20-MaTSO7-T49	5.34e-10	2.14e+00 -	0.00e+00 =	2.59e-01 -	1.13e-01 -	2.62e+00 -	2.11e+01 -
WCCI20-MaTSO7-T50	3.67e+02	3.60e+02 =	2.28e+02 +	1.76e+02 +	2.27e+02 +	3.49e+02 =	4.61e+02 -
+/-/=	Base	13/33/4	17/22/11	17/33/0	17/33/0	5/33/12	0/50/0

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Table 14: The comparison results of MTEA-ATS with other six algorithms on WCCI20-MaTSO8 problem

	MTEA-ATS	KR-MTEA	BoKTDE	MTEA-SaO	AEMTO	MaTDE	DE
WCCI20-MaTSO8-T1	9.21e+01	2.68e+02 -	1.40e+03 -	5.66e+02 -	1.58e+03 =	2.92e+02 -	2.65e+03 -
WCCI20-MaTSO8-T2	0.00e+00	1.88e-05 -	0.00e+00 =	2.99e-01 -	1.18e+00 -	3.01e+00 -	2.12e+01 -
WCCI20-MaTSO8-T3	3.76e+02	1.76e+02 +	1.23e+02 +	1.93e+02 +	2.48e+02 +	3.63e+02 =	4.57e+02 -
WCCI20-MaTSO8-T4	5.72e-08	3.10e-07 -	7.40e-04 -	1.40e-03 -	2.52e-03 -	1.24e-02 -	3.26e-01 -
WCCI20-MaTSO8-T5	2.04e+00	2.40e+01 -	2.02e+00 =	3.06e+01 -	1.41e+01 -	2.36e+01 -	6.73e+01 -
WCCI20-MaTSO8-T6	5.10e+01	5.17e+01 -	1.44e+03 -	1.36e+02 -	1.01e+02 =	2.44e+02 -	2.49e+03 -
WCCI20-MaTSO8-T7	0.00e+00	2.00e+00 -	1.16e-05 =	2.07e-02 -	1.87e-01 -	2.69e+00 -	2.12e+01 -
WCCI20-MaTSO8-T8	3.78e+02	3.54e+02 +	1.53e+02 +	2.10e+02 +	2.37e+02 +	3.59e+02 =	4.57e+02 -
WCCI20-MaTSO8-T9	1.96e-07	3.71e-02 -	6.76e-04 -	8.15e-04 -	1.58e-02 -	6.28e-03 -	3.48e-01 -
WCCI20-MaTSO8-T10	2.21e+00	3.88e+00 -	3.44e+00 =	3.05e+01 -	1.39e+01 -	2.59e+01 -	6.76e+01 -
WCCI20-MaTSO8-T11	5.08e+01	2.07e+02 -	1.49e+03 -	2.42e+02 -	9.62e+01 =	1.29e+02 -	1.45e+03 -
WCCI20-MaTSO8-T12	0.00e+00	2.24e-05 -	2.68e-05 =	2.61e-02 -	7.38e-01 -	2.71e+00 -	2.12e+01 -
WCCI20-MaTSO8-T13	3.86e+02	1.70e+02 +	1.79e+02 +	2.06e+02 +	2.67e+02 +	3.63e+02 =	4.61e+02 -
WCCI20-MaTSO8-T14	2.22e-08	3.88e-07 -	2.48e-04 -	3.73e-04 -	1.57e-02 -	9.85e-03 -	3.37e-01 -
WCCI20-MaTSO8-T15	1.73e+00	2.56e+01 -	3.41e+00 -	3.17e+01 -	1.75e+01 -	2.56e+01 -	6.79e+01 -
WCCI20-MaTSO8-T16	1.46e+02	1.13e+02 =	2.70e+02 -	7.67e+02 -	4.12e+02 -	3.34e+02 -	1.90e+03 -
WCCI20-MaTSO8-T17	2.82e-09	2.07e+00 -	0.00e+00 =	4.51e-02 -	2.85e-01 -	2.85e+00 -	2.12e+01 -
WCCI20-MaTSO8-T18	3.84e+02	3.55e+02 +	1.72e+02 +	2.08e+02 +	2.31e+02 +	3.75e+02 =	4.68e+02 -
WCCI20-MaTSO8-T19	1.20e-08	3.05e-02 -	1.04e-03 -	1.03e-03 -	1.64e-02 -	1.71e-02 -	3.17e-01 -
WCCI20-MaTSO8-T20	2.29e+00	3.81e+00 -	3.18e+00 -	3.18e+01 -	1.33e+01 -	2.53e+01 -	6.84e+01 -
WCCI20-MaTSO8-T21	4.77e+01	8.53e+02 -	3.21e+04 -	1.37e+02 -	3.43e+02 -	8.45e+03 -	2.24e+03 -
WCCI20-MaTSO8-T22	0.00e+00	2.94e-05 -	2.66e-01 -	9.84e-02 -	1.03e+00 -	2.88e+00 -	2.12e+01 -
WCCI20-MaTSO8-T23	3.83e+02	1.92e+02 +	1.66e+02 +	2.02e+02 +	2.49e+02 +	3.76e+02 =	4.65e+02 -
WCCI20-MaTSO8-T24	3.75e-08	1.83e-07 -	6.05e-04 -	2.14e-03 -	5.46e-02 -	1.13e-02 -	3.57e-01 -
WCCI20-MaTSO8-T25	1.59e+00	2.61e+01 -	2.87e+00 -	3.19e+01 -	1.50e+01 -	2.64e+01 -	6.76e+01 -
WCCI20-MaTSO8-T26	1.07e+02	9.08e+01 =	9.06e+02 -	2.11e+02 =	3.29e+02 =	7.19e+02 -	2.01e+03 -
WCCI20-MaTSO8-T27	0.00e+00	2.09e+00 -	9.13e-07 =	3.91e-02 -	1.84e-01 -	2.65e+00 -	2.12e+01 -
WCCI20-MaTSO8-T28	3.89e+02	3.53e+02 +	1.96e+02 +	1.97e+02 +	2.67e+02 +	3.77e+02 =	4.57e+02 -
WCCI20-MaTSO8-T29	1.96e-08	3.71e-02 -	9.49e-04 -	2.43e-03 -	3.62e-03 -	2.01e-02 -	3.44e-01 -
WCCI20-MaTSO8-T30	6.81e-01	1.67e+00 -	3.04e+00 -	3.13e+01 -	1.65e+01 -	2.49e+01 -	6.73e+01 -
WCCI20-MaTSO8-T31	2.62e+02	6.52e+02 -	4.04e+02 -	4.96e+02 =	7.15e+02 =	1.12e+03 -	3.51e+03 -
WCCI20-MaTSO8-T32	0.00e+00	1.34e-05 -	2.01e-01 =	3.92e-02 -	2.23e+00 -	2.64e+00 -	2.12e+01 -
WCCI20-MaTSO8-T33	3.82e+02	1.69e+02 +	2.19e+02 +	1.98e+02 +	2.28e+02 +	3.80e+02 =	4.54e+02 -
WCCI20-MaTSO8-T34	1.11e-08	2.69e-07 -	7.44e-04 -	1.57e-03 -	2.12e-02 -	7.98e-03 -	3.38e-01 -
WCCI20-MaTSO8-T35	1.17e+00	2.36e+01 -	2.49e+00 -	3.29e+01 -	1.29e+01 -	2.48e+01 -	6.75e+01 -
WCCI20-MaTSO8-T36	1.12e+02	7.54e+01 =	3.28e+02 =	3.92e+02 =	3.86e+02 -	8.34e+02 -	1.83e+03 -
WCCI20-MaTSO8-T37	0.00e+00	2.00e+00 -	5.88e-02 =	5.92e-02 -	5.68e-01 -	2.78e+00 -	2.12e+01 -
WCCI20-MaTSO8-T38	3.90e+02	3.59e+02 +	1.55e+02 +	1.82e+02 +	2.35e+02 +	3.95e+02 =	4.65e+02 -
WCCI20-MaTSO8-T39	1.57e-07	3.74e-02 -	3.97e-04 -	8.74e-04 -	8.82e-03 -	7.36e-03 -	3.45e-01 -
WCCI20-MaTSO8-T40	9.33e-01	1.51e+00 =	3.10e+00 -	3.33e+01 -	1.37e+01 -	2.28e+01 -	6.83e+01 -
WCCI20-MaTSO8-T41	2.48e+02	1.10e+03 -	9.84e+02 -	1.00e+03 =	6.44e+02 -	6.99e+02 -	1.72e+03 -
WCCI20-MaTSO8-T42	0.00e+00	5.44e-06 -	0.00e+00 =	3.84e-02 -	1.41e+00 -	2.58e+00 -	2.12e+01 -
WCCI20-MaTSO8-T43	3.86e+02	1.67e+02 +	2.01e+02 +	2.05e+02 +	2.29e+02 +	3.94e+02 =	4.56e+02 -
WCCI20-MaTSO8-T44	5.18e-08	2.20e-07 -	2.99e-04 -	1.04e-03 -	6.25e-03 -	9.25e-03 -	3.47e-01 -
WCCI20-MaTSO8-T45	1.17e+00	2.43e+01 -	2.20e+00 -	3.21e+01 -	1.11e+01 -	2.32e+01 -	6.79e+01 -
WCCI20-MaTSO8-T46	4.78e+01	4.79e+01 =	5.23e+03 -	6.04e+01 -	1.15e+02 -	2.27e+02 -	1.59e+03 -
WCCI20-MaTSO8-T47	0.00e+00	2.22e+00 -	2.30e-03 =	3.41e-02 -	3.37e-01 -	2.87e+00 -	2.12e+01 -
WCCI20-MaTSO8-T48	3.82e+02	3.52e+02 +	1.79e+02 +	1.90e+02 +	2.35e+02 +	3.85e+02 =	4.57e+02 -
WCCI20-MaTSO8-T49	5.70e-08	3.13e-02 -	8.40e-04 -	7.50e-04 -	2.52e-02 -	1.17e-02 -	3.40e-01 -
WCCI20-MaTSO8-T50	6.05e-01	2.24e+00 -	1.83e+00 -	3.16e+01 -	1.04e+01 -	2.32e+01 -	6.72e+01 -
+/-/=	Base	10/35/5	10/25/15	10/36/4	10/35/5	0/40/10	0/50/0

Table 15: The comparison results of MTEA-ATS with other six algorithms on WCCI20-MaTSO9 problem

	MTEA-ATS	KR-MTEA	BoKTDE	MTEA-SaO	AEMTO	MaTDE	DE
WCCI20-MaTSO9-T1	5.66e+02	8.04e+02 -	7.41e+02 =	2.93e+02 =	5.92e+02 =	3.59e+02 =	3.08e+03 -
WCCI20-MaTSO9-T2	0.00e+00	2.30e-05 -	0.00e+00 =	3.70e-02 -	2.01e-01 -	2.84e+00 -	2.12e+01 -
WCCI20-MaTSO9-T3	3.64e+02	2.01e+02 +	1.64e+02 +	2.01e+02 +	2.21e+02 +	3.58e+02 =	4.58e+02 -
WCCI20-MaTSO9-T4	3.48e-07	1.45e-07 +	1.86e-04 -	7.23e-04 -	7.39e-03 -	5.53e-03 -	3.57e-01 -
WCCI20-MaTSO9-T5	4.37e+00	2.61e+01 -	3.56e+00 =	3.40e+01 -	1.58e+01 -	2.53e+01 -	6.80e+01 -
WCCI20-MaTSO9-T6	1.27e+04	1.35e+04 -	1.28e+04 =	5.58e+03 +	1.19e+04 =	1.29e+04 =	1.24e+04 +
WCCI20-MaTSO9-T7	4.80e+01	2.51e+02 -	3.66e+03 -	1.98e+02 -	1.34e+02 -	3.50e+02 -	1.43e+03 -
WCCI20-MaTSO9-T8	1.36e-07	1.70e-05 -	1.69e-06 -	3.83e-02 -	7.08e-01 -	2.69e+00 -	2.11e+01 -
WCCI20-MaTSO9-T9	3.63e+02	1.95e+02 +	2.23e+02 +	1.76e+02 +	2.62e+02 +	3.80e+02 =	4.62e+02 -
WCCI20-MaTSO9-T10	0.00e+00	2.58e-08 -	3.92e-04 -	7.15e-04 -	7.12e-03 -	7.51e-03 -	3.33e-01 -
WCCI20-MaTSO9-T11	1.99e+00	2.53e+01 -	3.45e+00 -	2.96e+01 -	1.50e+01 -	2.57e+01 -	6.82e+01 -
WCCI20-MaTSO9-T12	1.28e+04	1.31e+04 =	1.21e+04 +	5.39e+03 +	1.17e+04 =	1.29e+04 =	1.20e+04 +
WCCI20-MaTSO9-T13	5.62e+01	2.63e+02 -	4.16e+03 -	1.58e+02 -	1.35e+02 -	4.35e+02 -	1.68e+03 -
WCCI20-MaTSO9-T14	0.00e+00	2.91e-05 -	1.47e-05 =	2.75e-02 -	3.13e-01 -	2.56e+00 -	2.11e+01 -
WCCI20-MaTSO9-T15	3.70e+02	1.86e+02 +	1.94e+02 +	1.61e+02 +	2.68e+02 +	3.98e+02 -	4.58e+02 -
WCCI20-MaTSO9-T16	2.99e-07	1.81e-07 +	1.02e-03 -	4.02e-04 -	1.65e-02 -	5.53e-03 -	3.31e-01 -
WCCI20-MaTSO9-T17	2.06e+00	2.48e+01 -	3.57e+00 -	3.20e+01 -	1.40e+01 -	2.55e+01 -	6.82e+01 -
WCCI20-MaTSO9-T18	1.26e+04	1.35e+04 -	1.23e+04 =	5.72e+03 +	1.23e+04 =	1.30e+04 -	1.22e+04 +
WCCI20-MaTSO9-T19	6.63e+01	3.35e+02 -	6.86e+02 -	4.15e+02 =	2.08e+02 =	2.52e+02 -	1.99e+03 -
WCCI20-MaTSO9-T20	0.00e+00	9.96e-05 -	3.45e-01 -	8.11e-01 -	3.15e+00 -	2.69e+00 -	2.12e+01 -
WCCI20-MaTSO9-T21	3.68e+02	1.83e+02 +	1.96e+02 +	1.98e+02 +	2.49e+02 +	3.79e+02 =	4.59e+02 -
WCCI20-MaTSO9-T22	3.91e-08	1.27e-07 -	1.49e-04 -	2.69e-04 -	2.09e-02 -	6.94e-03 -	3.39e-01 -
WCCI20-MaTSO9-T23	4.74e+00	2.67e+01 -	3.41e+00 =	3.34e+01 -	1.15e+01 -	2.70e+01 -	6.78e+01 -
WCCI20-MaTSO9-T24	1.30e+04	1.33e+04 -	1.18e+04 +	5.57e+03 +	1.18e+04 +	1.28e+04 =	1.21e+04 +
WCCI20-MaTSO9-T25	2.96e+02	1.49e+03 -	5.74e+02 =	9.93e+02 =	7.58e+02 -	9.78e+02 -	3.65e+03 -
WCCI20-MaTSO9-T26	0.00e+00	2.12e-05 -	1.53e-01 -	1.60e-01 -	3.50e-01 -	2.80e+00 -	2.12e+01 -
WCCI20-MaTSO9-T27	3.64e+02	1.92e+02 +	2.30e+02 +	1.88e+02 +	2.59e+02 +	3.88e+02 =	4.55e+02 -
WCCI20-MaTSO9-T28	3.55e-07	2.35e-07 +	5.61e-04 -	3.59e-04 -	1.69e-02 -	1.09e-02 -	3.56e-01 -
WCCI20-MaTSO9-T29	3.73e+00	2.62e+01 -	3.46e+00 =	3.27e+01 -	1.48e+01 -	2.48e+01 -	6.74e+01 -
WCCI20-MaTSO9-T30	1.30e+04	1.36e+04 -	1.29e+04 =	6.08e+03 +	1.22e+04 +	1.32e+04 =	1.24e+04 +
WCCI20-MaTSO9-T31	1.39e+02	9.41e+02 -	4.92e+02 -	7.72e+02 =	5.53e+02 -	1.34e+03 -	1.90e+03 -
WCCI20-MaTSO9-T32	0.00e+00	1.75e-05 -	3.33e-02 =	4.13e-02 -	2.32e+00 -	2.85e+00 -	2.12e+01 -
WCCI20-MaTSO9-T33	3.67e+02	1.73e+02 +	1.66e+02 +	2.07e+02 +	2.61e+02 +	3.79e+02 =	4.58e+02 -
WCCI20-MaTSO9-T34	3.43e-09	1.40e-07 -	7.90e-04 -	4.12e-04 -	4.33e-03 -	8.51e-03 -	3.39e-01 -
WCCI20-MaTSO9-T35	2.64e+00	2.63e+01 -	3.15e+00 -	2.84e+01 -	1.50e+01 -	2.52e+01 -	6.78e+01 -
WCCI20-MaTSO9-T36	1.31e+04	1.35e+04 -	1.24e+04 +	5.77e+03 +	1.23e+04 +	1.30e+04 =	1.21e+04 +
WCCI20-MaTSO9-T37	1.46e+02	2.40e+02 -	2.14e+03 -	3.05e+02 -	3.08e+02 -	2.54e+02 -	1.25e+03 -
WCCI20-MaTSO9-T38	2.37e-06	3.58e-05 -	1.81e-01 -	6.38e-02 -	4.87e-01 -	2.83e+00 -	2.12e+01 -
WCCI20-MaTSO9-T39	3.70e+02	1.74e+02 +	2.04e+02 +	1.74e+02 +	2.04e+02 +	3.95e+02 =	4.64e+02 -
WCCI20-MaTSO9-T40	1.92e-06	1.01e-07 +	9.39e-04 -	3.89e-04 -	2.10e-02 -	9.30e-03 -	3.24e-01 -
WCCI20-MaTSO9-T41	2.12e+00	2.58e+01 -	2.80e+00 =	3.08e+01 -	1.54e+01 -	2.51e+01 -	6.76e+01 -
WCCI20-MaTSO9-T42	1.28e+04	1.30e+04 =	1.23e+04 +	5.01e+03 +	1.14e+04 +	1.25e+04 =	1.20e+04 +
WCCI20-MaTSO9-T43	6.47e+01	3.09e+02 -	3.98e+02 -	2.91e+02 -	2.53e+02 -	2.97e+02 -	2.92e+03 -
WCCI20-MaTSO9-T44	0.00e+00	1.24e-05 -	5.24e-01 -	5.04e-02 -	1.25e+00 -	2.77e+00 -	2.12e+01 -
WCCI20-MaTSO9-T45	3.65e+02	1.77e+02 +	1.35e+02 +	2.10e+02 +	2.63e+02 +	3.66e+02 =	4.58e+02 -
WCCI20-MaTSO9-T46	0.00e+00	3.41e-07 -	7.71e-04 -	1.22e-03 -	5.22e-02 -	1.11e-02 -	3.36e-01 -
WCCI20-MaTSO9-T47	2.88e+00	2.62e+01 -	2.86e+00 =	2.86e+01 -	1.54e+01 -	2.29e+01 -	6.73e+01 -
WCCI20-MaTSO9-T48	1.27e+04	1.34e+04 -	1.24e+04 =	5.27e+03 +	1.21e+04 =	1.31e+04 -	1.24e+04 =
WCCI20-MaTSO9-T49	6.26e+01	5.84e+02 -	2.62e+03 -	1.16e+02 -	9.05e+01 =	3.53e+02 -	7.40e+02 -
WCCI20-MaTSO9-T50	5.67e-07	1.79e-05 -	3.85e-02 =	7.04e-01 -	1.30e-01 -	2.62e+00 -	2.12e+01 -
+/-/=	Base	12/35/3	12/20/18	16/30/4	12/30/8	0/37/13	7/42/1

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Table 16: The comparison results of MTEA-ATS with other six algorithms on WCCI20-MaTSO10 problem

	MTEA-ATS	KR-MTEA	BoKTDE	MTEA-SaO	AEMTO	MaTDE	DE
WCCI20-MaTSO10-T1	0.00e+00	2.05e+00 -	1.94e-06 =	2.75e-02 -	1.06e+00 -	2.76e+00 -	2.12e+01 -
WCCI20-MaTSO10-T2	3.60e+02	3.61e+02 =	2.60e+02 +	2.03e+02 +	2.60e+02 +	3.69e+02 -	4.63e+02 -
WCCI20-MaTSO10-T3	3.64e-08	3.83e-02 -	5.67e-04 -	1.61e-03 -	6.18e-03 -	8.26e-03 -	3.30e-01 -
WCCI20-MaTSO10-T4	2.78e+00	3.76e+00 =	2.33e+00 =	3.12e+01 -	1.53e+01 -	2.63e+01 -	6.73e+01 -
WCCI20-MaTSO10-T5	1.31e+04	4.72e+03 +	1.29e+04 =	5.65e+03 +	1.17e+04 +	1.30e+04 =	1.24e+04 +
WCCI20-MaTSO10-T6	0.00e+00	3.96e-05 -	3.35e-05 -	6.59e-02 -	1.23e+00 -	2.63e+00 -	2.12e+01 -
WCCI20-MaTSO10-T7	3.65e+02	1.78e+02 +	2.45e+02 +	2.01e+02 +	2.36e+02 +	3.82e+02 -	4.60e+02 -
WCCI20-MaTSO10-T8	4.69e-08	1.47e-07 -	5.21e-04 -	3.90e-04 -	6.94e-03 -	6.91e-03 -	3.23e-01 -
WCCI20-MaTSO10-T9	2.52e+00	2.35e+01 -	1.76e+00 =	3.14e+01 -	1.28e+01 -	2.43e+01 -	6.71e+01 -
WCCI20-MaTSO10-T10	1.30e+04	1.37e+04 -	1.18e+04 -	6.41e+03 +	1.23e+04 =	1.34e+04 -	1.26e+04 +
WCCI20-MaTSO10-T11	0.00e+00	2.09e+00 -	2.05e-07 =	4.44e-02 -	1.33e+00 -	2.80e+00 -	2.12e+01 -
WCCI20-MaTSO10-T12	3.62e+02	3.56e+02 =	2.30e+02 +	2.24e+02 +	2.12e+02 +	3.75e+02 -	4.54e+02 -
WCCI20-MaTSO10-T13	0.00e+00	3.33e-02 -	1.48e-04 -	7.54e-04 -	8.29e-03 -	1.52e-02 -	3.48e-01 -
WCCI20-MaTSO10-T14	2.67e+00	3.61e+00 =	2.34e+00 =	3.00e+01 -	1.38e+01 -	2.69e+01 -	6.78e+01 -
WCCI20-MaTSO10-T15	1.29e+04	4.02e+03 +	1.17e+04 +	5.13e+03 +	1.17e+04 =	1.29e+04 =	1.20e+04 +
WCCI20-MaTSO10-T16	0.00e+00	9.36e-05 -	6.90e-01 -	1.22e+00 -	4.88e+00 -	2.78e+00 -	2.12e+01 -
WCCI20-MaTSO10-T17	3.66e+02	1.86e+02 +	2.46e+02 +	2.17e+02 +	2.48e+02 +	3.63e+02 =	4.58e+02 -
WCCI20-MaTSO10-T18	6.17e-08	2.49e-07 -	5.80e-04 -	2.80e-03 -	6.17e-03 -	1.27e-02 -	3.45e-01 -
WCCI20-MaTSO10-T19	1.75e+00	2.62e+01 -	1.85e+00 =	3.12e+01 -	1.40e+01 -	2.49e+01 -	6.68e+01 -
WCCI20-MaTSO10-T20	1.28e+04	1.36e+04 -	1.23e+04 -	5.73e+03 +	1.15e+04 -	1.31e+04 -	1.24e+04 +
WCCI20-MaTSO10-T21	0.00e+00	2.17e+00 -	1.45e-04 -	2.71e-02 -	2.54e-01 -	2.60e+00 -	2.12e+01 -
WCCI20-MaTSO10-T22	3.69e+02	3.62e+02 =	2.54e+02 +	2.11e+02 +	2.38e+02 +	3.82e+02 -	4.59e+02 -
WCCI20-MaTSO10-T23	7.09e-07	3.87e-02 -	7.46e-04 -	4.04e-04 -	2.10e-02 -	7.39e-03 -	3.41e-01 -
WCCI20-MaTSO10-T24	2.37e+00	3.83e+00 -	2.16e+00 =	3.25e+01 -	1.64e+01 -	2.35e+01 -	6.79e+01 -
WCCI20-MaTSO10-T25	1.28e+04	4.13e+03 +	1.25e+04 =	5.16e+03 +	1.21e+04 =	1.26e+04 =	1.20e+04 +
WCCI20-MaTSO10-T26	0.00e+00	2.12e-05 -	2.23e-01 -	4.65e-01 -	1.22e+00 -	2.67e+00 -	2.12e+01 -
WCCI20-MaTSO10-T27	3.62e+02	1.84e+02 +	2.41e+02 +	2.09e+02 +	2.06e+02 +	3.62e+02 =	4.62e+02 -
WCCI20-MaTSO10-T28	9.70e-07	1.70e-07 +	1.05e-03 -	1.68e-03 -	1.89e-02 -	1.02e-02 -	3.26e-01 -
WCCI20-MaTSO10-T29	3.16e+00	2.60e+01 -	3.24e+00 =	3.43e+01 -	1.43e+01 -	2.56e+01 -	6.76e+01 -
WCCI20-MaTSO10-T30	1.28e+04	1.33e+04 -	1.27e+04 -	5.59e+03 +	1.19e+04 =	1.29e+04 -	1.22e+04 +
WCCI20-MaTSO10-T31	0.00e+00	2.21e+00 -	1.80e-03 =	3.10e-02 -	3.01e-01 -	2.44e+00 -	2.12e+01 -
WCCI20-MaTSO10-T32	3.70e+02	3.61e+02 =	2.92e+02 +	2.05e+02 +	2.22e+02 +	3.68e+02 -	4.61e+02 -
WCCI20-MaTSO10-T33	4.04e-07	2.95e-02 -	7.86e-04 -	1.16e-03 -	1.17e-02 -	4.96e-03 -	3.41e-01 -
WCCI20-MaTSO10-T34	3.58e+00	4.92e+00 =	3.25e+00 =	3.23e+01 -	1.43e+01 -	2.55e+01 -	6.79e+01 -
WCCI20-MaTSO10-T35	1.30e+04	4.44e+03 +	1.21e+04 +	5.47e+03 +	1.22e+04 =	1.31e+04 -	1.22e+04 +
WCCI20-MaTSO10-T36	0.00e+00	1.76e-05 -	3.71e-01 -	1.07e+00 -	9.89e-01 -	2.67e+00 -	2.12e+01 -
WCCI20-MaTSO10-T37	3.64e+02	2.01e+02 +	2.34e+02 +	2.18e+02 +	2.35e+02 +	3.68e+02 -	4.59e+02 -
WCCI20-MaTSO10-T38	1.19e-09	2.54e-08 -	3.80e-04 -	1.18e-03 -	3.53e-02 -	8.65e-03 -	3.30e-01 -
WCCI20-MaTSO10-T39	2.03e+00	2.37e+01 -	1.97e+00 =	3.08e+01 -	1.38e+01 -	2.31e+01 -	6.73e+01 -
WCCI20-MaTSO10-T40	1.30e+04	1.35e+04 -	1.16e+04 +	5.96e+03 +	1.21e+04 =	1.30e+04 -	1.24e+04 +
WCCI20-MaTSO10-T41	0.00e+00	2.16e+00 -	3.55e-04 =	5.69e-02 -	1.56e+00 -	2.94e+00 -	2.12e+01 -
WCCI20-MaTSO10-T42	3.70e+02	3.52e+02 +	2.11e+02 +	1.82e+02 +	2.69e+02 +	3.91e+02 -	4.54e+02 -
WCCI20-MaTSO10-T43	0.00e+00	3.79e-02 -	7.43e-04 -	1.27e-03 -	9.94e-03 -	7.28e-03 -	3.38e-01 -
WCCI20-MaTSO10-T44	2.04e+00	3.26e+00 =	2.78e+00 =	3.17e+01 -	1.34e+01 -	2.50e+01 -	6.74e+01 -
WCCI20-MaTSO10-T45	1.26e+04	3.75e+03 +	1.25e+04 =	5.59e+03 +	1.24e+04 =	1.31e+04 -	1.21e+04 +
WCCI20-MaTSO10-T46	0.00e+00	5.18e-05 -	3.83e-01 -	2.26e-01 -	1.15e+00 -	2.75e+00 -	2.12e+01 -
WCCI20-MaTSO10-T47	3.62e+02	1.82e+02 +	2.68e+02 +	2.26e+02 +	2.30e+02 +	3.71e+02 -	4.58e+02 -
WCCI20-MaTSO10-T48	3.71e-04	2.83e-07 +	2.46e-04 +	3.84e-04 -	7.78e-03 -	1.16e-02 -	3.43e-01 -
WCCI20-MaTSO10-T49	3.62e+00	2.87e+01 -	3.68e+00 =	3.32e+01 -	1.39e+01 -	2.76e+01 -	6.79e+01 -
WCCI20-MaTSO10-T50	1.26e+04	1.32e+04 -	1.25e+04 =	5.42e+03 +	1.16e+04 =	1.28e+04 -	1.22e+04 +
+/-/=	Base	13/29/8	14/15/21	20/30/0	11/30/9	0/32/18	10/40/0

Table 17: the comparison results of MTEA-ATS with MTEA-ATS-ET, MTEA-ATS-IT, MTEA-ATS-NTS, and MTEA-NDRS on WCCI20-MaTSO9 problem

	MTEA-ATS	MTEA-ATS-ET	MTEA-ATS-IT	MTEA-ATS-NTS	MTEA-ATS-NDRS
WCCI20-MaTSO9-T1	3.71e+02	3.34e+02 =	3.18e+02 +	**1.99e+02** =	3.21e+02 =
WCCI20-MaTSO9-T2	**0.00e+00**	2.35e-09 -	4.48e-03 -	**0.00e+00** =	7.75e-09 -
WCCI20-MaTSO9-T3	3.65e+02	3.78e+02 -	3.68e+02 =	**3.64e+02** =	3.66e+02 =
WCCI20-MaTSO9-T4	8.63e-04	**3.95e-09** =	2.69e-03 -	5.46e-07 =	1.53e-06 +
WCCI20-MaTSO9-T5	3.73e+00	**1.52e+00** +	6.29e+00 -	4.44e+00 =	3.62e+00 =
WCCI20-MaTSO9-T6	1.28e+04	1.33e+04 -	**1.21e+04** +	1.29e+04 =	1.27e+04 =
WCCI20-MaTSO9-T7	5.43e+01	**4.77e+01** =	4.82e+01 =	4.81e+01 =	4.82e+01 =
WCCI20-MaTSO9-T8	8.05e-08	9.05e-10 =	2.18e-02 -	**0.00e+00** =	6.34e-07 -
WCCI20-MaTSO9-T9	**3.65e+02**	3.81e+02 -	**3.65e+02** =	3.68e+02 =	3.66e+02 =
WCCI20-MaTSO9-T10	**0.00e+00**	1.67e-07 -	6.77e-04 -	**0.00e+00** =	4.47e-09 -
WCCI20-MaTSO9-T11	**2.23e+00**	3.04e-01 +	4.77e+00 -	2.85e+00 =	**2.23e+00** =
WCCI20-MaTSO9-T12	1.27e+04	1.32e+04 -	**1.25e+04** =	1.28e+04 =	1.27e+04 =
WCCI20-MaTSO9-T13	4.80e+01	**4.73e+01** +	8.67e+01 -	4.78e+01 =	5.62e+01 =
WCCI20-MaTSO9-T14	**0.00e+00**	**0.00e+00** =	3.81e-03 -	**0.00e+00** =	1.22e-05 -
WCCI20-MaTSO9-T15	**3.56e+02**	3.75e+02 -	3.70e+02 =	3.68e+02 -	3.67e+02 =
WCCI20-MaTSO9-T16	3.50e-07	**7.50e-08** +	1.60e-03 -	1.61e-07 =	2.76e-06 -
WCCI20-MaTSO9-T17	2.06e+00	**4.93e-01** +	4.55e+00 -	1.83e+00 =	2.53e+00 =
WCCI20-MaTSO9-T18	1.28e+04	1.34e+04 -	**1.11e+04** +	1.28e+04 =	1.28e+04 =
WCCI20-MaTSO9-T19	6.76e+01	6.38e+01 +	9.28e+01 =	6.83e+01 =	**5.09e+01** +
WCCI20-MaTSO9-T20	1.10e-06	1.60e-09 =	3.20e-04 -	**0.00e+00** =	2.90e-13 +
WCCI20-MaTSO9-T21	3.68e+02	3.73e+02 =	**3.65e+02** =	3.67e+02 =	3.67e+02 =
WCCI20-MaTSO9-T22	**2.74e-09**	2.89e-08 -	1.69e-03 -	3.25e-09 =	1.48e-06 -
WCCI20-MaTSO9-T23	4.43e+00	**2.38e+00** +	7.45e+00 -	4.76e+00 =	3.57e+00 =
WCCI20-MaTSO9-T24	1.29e+04	1.32e+04 =	**1.23e+04** +	1.28e+04 =	1.29e+04 =
WCCI20-MaTSO9-T25	3.03e+02	**1.50e+02** =	5.58e+02 =	5.45e+02 =	5.30e+02 =
WCCI20-MaTSO9-T26	**0.00e+00**	2.20e-09 =	2.43e-03 -	**0.00e+00** =	8.09e-13 -
WCCI20-MaTSO9-T27	3.63e+02	3.78e+02 -	**3.51e+02** =	3.63e+02 =	3.72e+02 -
WCCI20-MaTSO9-T28	1.54e-07	7.18e-08 +	3.61e-03 -	1.44e-07 =	**4.92e-08** +
WCCI20-MaTSO9-T29	2.85e+00	**1.25e+00** +	6.16e+00 -	3.22e+00 =	3.08e+00 =
WCCI20-MaTSO9-T30	1.30e+04	1.36e+04 -	**1.24e+04** +	1.32e+04 =	1.28e+04 =
WCCI20-MaTSO9-T31	2.42e+02	**2.06e+02** =	2.49e+02 =	4.99e+02 =	2.96e+02 =
WCCI20-MaTSO9-T32	**0.00e+00**	1.32e-09 =	8.63e-03 -	**0.00e+00** =	3.45e-13 -
WCCI20-MaTSO9-T33	3.65e+02	3.78e+02 -	**3.60e+02** =	3.69e+02 =	3.67e+02 =
WCCI20-MaTSO9-T34	**2.30e-09**	8.77e-08 -	2.63e-04 -	3.15e-07 =	1.54e-06 -
WCCI20-MaTSO9-T35	2.24e+00	**8.22e-01** +	5.15e+00 -	2.69e+00 =	2.93e+00 =
WCCI20-MaTSO9-T36	1.30e+04	1.32e+04 =	**1.25e+04** +	1.30e+04 =	1.30e+04 =
WCCI20-MaTSO9-T37	**5.10e+01**	6.15e+01 =	9.21e+01 =	1.03e+02 =	6.96e+01 =
WCCI20-MaTSO9-T38	1.37e-04	6.76e-10 =	1.33e-03 -	**0.00e+00** =	3.69e-13 +
WCCI20-MaTSO9-T39	3.67e+02	3.79e+02 -	**3.61e+02** =	3.71e+02 =	3.63e+02 =
WCCI20-MaTSO9-T40	4.72e-07	1.67e-08 =	2.37e-03 -	1.54e-08 =	**9.96e-08** +
WCCI20-MaTSO9-T41	1.61e+00	**6.13e-01** +	5.59e+00 -	2.33e+00 =	1.50e+00 =
WCCI20-MaTSO9-T42	1.25e+04	1.31e+04 -	**1.23e+04** =	1.26e+04 =	**1.23e+04** =
WCCI20-MaTSO9-T43	6.11e+01	**5.11e+01** =	1.21e+02 -	8.45e+01 =	7.39e+01 =
WCCI20-MaTSO9-T44	**0.00e+00**	**0.00e+00** =	9.49e-03 -	6.14e-07 =	6.46e-09 -
WCCI20-MaTSO9-T45	3.63e+02	3.77e+02 -	**3.59e+02** =	3.62e+02 =	3.70e+02 =
WCCI20-MaTSO9-T46	**0.00e+00**	1.46e-07 -	1.45e-03 -	1.11e-09 =	6.50e-10 -
WCCI20-MaTSO9-T47	2.86e+00	**9.12e-01** +	5.54e+00 -	3.19e+00 =	2.78e+00 =
WCCI20-MaTSO9-T48	1.26e+04	1.33e+04 -	**1.19e+04** +	1.26e+04 =	1.25e+04 =
WCCI20-MaTSO9-T49	5.56e+01	6.14e+01 =	**5.24e+01** =	7.13e+01 =	5.90e+01 =
WCCI20-MaTSO9-T50	1.74e-04	2.74e-09 =	1.08e-02 -	**0.00e+00** =	2.84e-04 -
+/-/=	Base	12/18/20	7/28/15	0/1/49	6/13/31
MSS	**-1.23e-01**	-2.25e-02 -	3.03e-01 -	-4.61e-02 -	-1.11e-01 =

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