

APPENDIX B Verification of the PSO algorithm

For the proposed design approach, it is implemented with the Matlab code. The PSO algorithm is of vital importance in finding the right solution, and it needs to be evaluated. To verify the effectiveness of the code, it was applied in the search process to search for the maximum value of two typical functions listed in Table S.1. Fig S. 1 shows the related results of the test functions. In the Figure, it is illustrated that the spurious solutions are avoided and the maximum values are found out just within 200 generations, which demonstrates the feasibility of PSO code.

Table S. 1 Test functions and its constraints

Objective functions	Constraints and the maximum
$f_1(x, y) = \frac{\sin\sqrt{x^2 + y^2}}{\sqrt{x^2 + y^2}} + e^{\frac{\cos 2\pi x + \cos 2\pi y}{2}} - 2.71289$	① Constraints: $-1.5 \leq x \leq 1.5$; $-1.5 \leq y \leq 1.5$ ② The maximum: $f_1(0,0) = 1.0054$
$f_2(x, y) = -20 - x^2 - y^2 + 10(\cos 2\pi x + \cos 2\pi y)$	① Constraints: $-5 \leq x \leq 5$; $-5 \leq y \leq 5$ ② The maximum: $f_2(0,0) = 0$

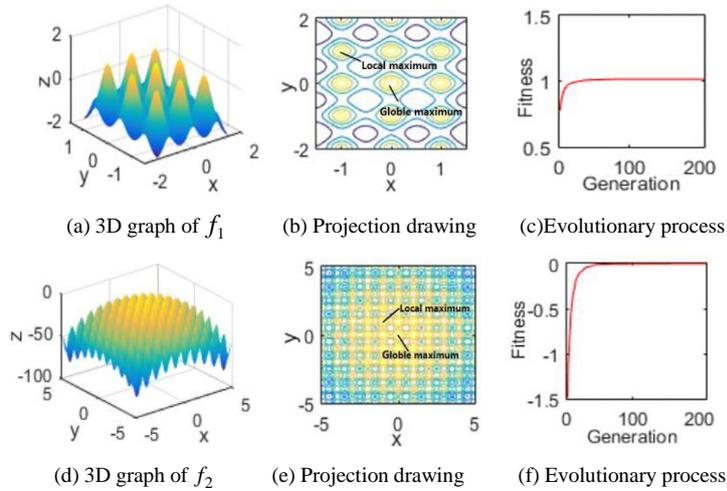


Fig S. 1 Results for the test functions