Fractional-order particle swarm optimizer

PSO is first proposed by Eberhart and Kennedy in 1995, and FPSO proposed by Solteiro Pires et al. Integer-order PSO with the inertia weight and coefficient of adaptive nonlinear time-varying had adaptability of diversity and provide excellent computing effectiveness. Therefore, this study rewrote the FPSO expression as the following:

\[ V_i(k+1) = \omega(k) \cdot V_i(k) + c_1(k) \cdot r_1 \cdot [ P_i^l(k) - \lambda \cdot p_i(k) - (\lambda/2) \cdot (1-\lambda) \cdot p_i(k-1) \\
- (\lambda/6) \cdot (1-\lambda) \cdot (2-\lambda) \cdot p_i(k-2) \\
+ (\lambda/24) \cdot (1-\lambda) \cdot (2-\lambda) \cdot p_i(k-3) ] \\
+ c_2(k) \cdot r_1 \cdot ( P_i^g(k) - p_i(k) ) , \]

\[ p_i(k+1) = p_i(k) + V_i(k+1) , \]

where \( \omega(k) \) means time-varying inertia weight, \( \omega(k) \in [\omega_{min}, \omega_{max}] \), \( c_i(k) \) is individual time-varying cognitive parameter, \( c_i(k) \in [c_{min}, c_{max}] \), and \( c_i(k) \) represents time-varying social knowledge parameter, \( c_i(k) \in [c_{2min}, c_{2max}] \).

Improved uniform design method

The following two steps give the stage in this experiment.

1. Define the parameters, select a suitable uniform layout, and set a stepwise ratio.
2. Best combination strategy with a stepwise ratio.

Best selection for the parameters of FPSO

For parameters selection, using \( U_{23}(23^4) \) uniform layout in improved uniform design method searches for the best combination of parameter values. The results are shown as Fig. 1 and 2. Table 1 and 2 show the best combination of parameter values and results from test functions.