

while $k \leq M_g$ **do**

$$x_i(k) = L_i + z_i(k) \cdot (U_i - L_i), i = 1, \dots, n$$

if $f(X(k)) < \bar{f}$ **then**

$$\bar{X} = X(k); \bar{f} = f(x(k))$$

end if

– **Step 2-1:** sub algorithm of first chaotic global-local search:

while $j \leq M_{gl1}$ **do**

for $i = 1$ to n **do**

if $r \leq 0.5$ **then** (where r is a uniformly distributed random variable with range $[0, 1]$)

$$x_i(j) = \bar{x}_i + \lambda_{gl1} z_i(j) \cdot |(U_i - L_i)|$$

else

$$x_i(j) = \bar{x}_i - \lambda_{gl1} z_i(j) \cdot |(U_i - L_i)|$$

end if

end for

if $f(X(j)) < \bar{f}$ **then**

$$\bar{X} = X(j); \bar{f} = f(x(j))$$

end if

$$j = j + 1$$

end while

– **Step 2-2:** sub algorithm of second chaotic global-local search:

while $s \leq M_{gl2}$ **do**

for $i = 1$ to n **do**

if $r \leq 0.5$ **then**

$$x_i(s) = \bar{x}_i + \lambda_{gl2} z_i(s) \cdot |(U_i - L_i)|$$

else

$$x_i(s) = \bar{x}_i - \lambda_{gl2} z_i(s) \cdot |(U_i - L_i)|$$

end if

end for

if $f(X(s)) < \bar{f}$ **then**

$$\bar{X} = X(s); \bar{f} = f(x(s))$$

end if

$$s = s + 1$$

end while

$$k = k + 1$$

end while

– **Step 3:** algorithm of chaotic local search:

while $k \leq M_g \times (M_{gl1} + M_{gl2}) + M_l$ **do**

for $i = 1$ to n **do**

if $r \leq 0.5$ **then**

$$x_i(k) = \bar{x}_i + \lambda z_i(k) \cdot |(U_i - L_i)|$$

else

$$x_i(k) = \bar{x}_i - \lambda z_i(k) \cdot |(U_i - L_i)|$$

end if

end for

if $f(X(k)) < \bar{f}$ **then**

$$\bar{X} = X(k); \bar{f} = f(x(k))$$

end if

$$k = k + 1$$

end while