**NOMENCLATURE**

- **A**: inter-cell move matrix
- **AU**: intra-cell machine load unbalance
- **a_{ij}**: element of machine part incident matrix
- **b_{ij}**: bottom-up weight vector
- **B_{ij}**: fixed bottom-up weights
- **C**: counter
- **c_i**: output of \( i \) comparison layer neuron - "logical AND" operator applied between \( X_i \) and \( I_j \)
- **C_{MAX}**: number of iterations to be performed in the particular temperature
- **D**: number of 1s in the \( X_i \) vector
- **d**: the number of 1s in the diagonal block
- **d_i**: the production volume of part \( i \)
- **E**: total number of exceptional elements
- **e**: number of exceptional elements in the particular input vector
- **e_1**: cell-density measure
- **e_2**: inter-cell material flows
- **G**: total number of manufacturing cell
- **G_N**: number of generations
- **h_i**: "logical OR" applied between the \( T_j \) and \( X_i \)
- **I_{U}**: inter-cell machine load unbalance
- **I_{M}**: inter-cell flows matrix
- **J**: candidate of cluster
- **k**: cell index
- **K**: number of 1s in the resulting vector \( c_i \)
- **L**: constant
- **L_{m}**: minimum allowable number of machines in each cell
- **l**: total number of equal largest value vectors
- **m**: the total number of input neurons
Nomenclature (Contd.)

\( M \) the total number of machines
\( M_n \) maximum number of machines permitted in a particular cell
\( m_r \) maximum number of machines permitted in the remainder cell
\( M_k \) number of machines in cell \( k \)
\( N \) total number of parts
\( n \) population size
\( o \) number of 1s in the machine-part incidence matrix

\( OFV \) sum of exceptional element
\( P \) total number of parts
\( p_c \) crossover probability
\( P(E) \) probability distribution
\( P_{ij} \) processing time of part \( j \) on machine \( i \)
\( p_m \) mutation probability
\( q \) weighting factor \( (0 \leq q \leq 1) \) that fixes the relative importance between voids and inter-cell movements
\( r_j \) output of \( j \) recognition layer neuron
\( R_{ijr} \) the set of the operation sequence number along which part \( i \) visits machine \( j \)

\( R_{MAX} \) maximum repetition allowed.
\( R_{M} \) total number of cells including remainder cell
\( S \) similarity ratio
\( T \) temperature
\( T_{ij} \) fixed top-down weights
\( t_{ij} \) top-down weight
\( U_i \) utilization of machine \( i \)
\( UC_k \) utilization of cell \( k \)
\( UL_k \) machine load unbalance of cell \( k \)
\( V_j \) volume of parts
Nomenclature (Contd.)

- \( v \): number of voids in the solution
- \( W_g \): fixed weight used in modified KSOM networks
- \( w_1 \): weightage factor for inter-cell moves \((0 \leq w_1 \leq 1)\)
- \( w_2 \): weightage factor for intra-cell moves \((0 \leq w_2 \leq 1)\)
- \( w_{ij} \): random weight used in modified KSOM
- \( WX_{i,k} \): weightage for the connections between the \( i \) machine input neuron on the \( k \) output cell neuron
- \( X_i \): input vectors applied to the network from the incidence matrix
- \( x^1 \): initial point
- \( x^2 \): neighbour point
- \( x_{ik} \): binary value indicating machine \( i \) is assigned to cell \( k \)
- \( y_i \): "logical OR operator" applied between \( X_i \) and \( t_i \)
- \( y_{ik} \): binary value indicating if part \( j \) is assigned to cell \( k \)
- \( YW_{j,k} \): weightage for the connections between the \( j \) component neuron on the \( k \) output cell neuron
- \( Z \): cost function
- \( Z(\text{best}) \): best objective function value
- \( Z(\text{current}) \): objective function value for current point
- \( \delta \): cooling rate
- \( \beta \): reduction rate in repetition
- \( \tau \): grouping efficacy
- \( \eta \): grouping efficiency
- \( \varphi \): the ratio of exceptional element to the total number of elements
- \( \phi \): the ratio of the number of voids in the diagonal blocks to the total number of elements
- \( \alpha \): learning rate
- \( \rho \): vigilance parameter
- \( \varepsilon \): termination criteria