### List of Most Commonly Used Symbols and Abbreviations

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<th>Explanation</th>
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<td>$p^{th}$ output</td>
</tr>
<tr>
<td>$l$</td>
<td>Number of outputs</td>
</tr>
<tr>
<td>$u_q$</td>
<td>$q^{th}$ input</td>
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<tr>
<td>$r$</td>
<td>Number of inputs</td>
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<tr>
<td>$A_{ip}^k$</td>
<td>Fuzzy set for $i^{th}$ premise variable in $k^{th}$ rule for $p^{th}$ output</td>
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<td>$B_{ip}^k$</td>
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### Chapter 1

- $y_p$  $p^{th}$ output
- $l$ Number of outputs
- $u_q$ $q^{th}$ input
- $r$ Number of inputs
- $A_{ip}^k$ Fuzzy set for $i^{th}$ premise variable in $k^{th}$ rule for $p^{th}$ output
- $B_{ip}^k$ Consequent fuzzy set in $k^{th}$ rule for $p^{th}$ output
- $\mu_{ip}^k(x_i)$ Membership function for fuzzy set $A_{ip}^k$
- $\mu_p^k(x)$ Firing strength of $k^{th}$ rule for $p^{th}$ output
- $A_p^k$ Fuzzy set corresponding to $\mu_p^k(x)$ in premise variable space
- $f_p^k(x)$ Local model that represent consequent part of TS model in $k^{th}$ rule for $p^{th}$ output

### Chapter 2

- $n$ Number of premise variable
- $n_k$ Number of premise variable in $k^{th}$ rule
\( m \) Number of rules

\( M \) Number of data set

\( X_i^k \) Fuzzy set defined at \( x_{ik} \) along \( y = y_k \) in \( x_i-y \) space

\( \mu_{X_i^k} \) Membership function for fuzzy set \( X_i^k \)

\( y_i^o(x_i) \) Output of AFDM

AFDM Approximate Fuzzy Data model

\( p^k \) Probability of \( k^{th} \) datum

\( p \) Maximum number of partitioning for premise variables

\( J \) Objective function [i.e., normalized mean square error of the model defined by eqn. (5.1)]

Chapter 3

\( A_i^k \) Fuzzy set for \( i^{th} \) premise variable in \( k^{th} \) rule

\( \mu_i^k(x_i) \) Membership function for fuzzy set \( A_i^k \)

\( \mu^k(x^k) \) Firing strength of \( k^{th} \) rule

\( B^k \) Consequent fuzzy set for in \( k^{th} \) rule

\( \phi^k(y) \) Membership function for fuzzy set \( B^k \)

\( b_k \) Centroid of \( B^k \)

\( v_k \) Area of \( B^k \)
GFM Generalized Fuzzy Model
WGTF Width of Gaussian type function
RBF Radial Basis Function
GRBF Generalized RBF
GRBFN GRBF Network
\( \sigma_k \) WGTF
\( \phi_k(x) \) GRBF operating on vector \( x \)
\( c_k \) Center vector of GRBF \( \phi_k(x) \)
\( a_k \) vector formed by inverse of WGTF for GRBF \( \phi_k(x) \)
\( l_k \) Power vector for GRBF \( \phi_k(x) \)

Chapter 4
AIC Akaike Information Criterion
SIC Structure Identification Criterion
\( J_{ry} \) Objective function for fuzzy C-means clustering defined by eqn. (4.7)
\( S \) Cluster validity function (defined by 4.13 and 4.22)

Chapter 5
GD Gradient Descent
LSE Least Square Estimate
GA Genetic Algorithms
SA Simulated Annealing
Chapter 6

FCCU  Fluidized Catalytic Cracking Unit
RRSF  Reactor-Regenerator-Stripper-Fractionator
CCR   Catalyst Circulation Rate
FPH   Feed Pre-Heat
DCS   Distributed Control System