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List of Acronyms

FOC	Fractional Order Control
PID	Proportional Integral and Derivative
FOPID	Fractional Order Proportional Integral and Derivative
FOPI	Fractional Order Proportional and Integral
CRONE	Commande Robuste d'Ordre Non-Entier
NINTEGER	Non-Integer
FOMCON	Fractional Order Modeling and Control
TID	Tilted Integral and Derivative
FO[PD]	Fractional Order of Proportional and Derivative
FO[PI]	Fractional Order of Proportional and Integral
IMC	Internal Model Control
TE	Trial and Error
ZN	Ziegler and Nichols
NM	Nelder's Mead
GWO	Grey Wolf Optimizer
MGWO	Modified Grey Wolf Optimizer
PSO	Particle Swarm Optimization
GA	Genetic Algorithm
PWM	Pulse Width Modulation
ITAE	Integral Time Weighted Absolute Error
IAE	Integral of Absolute Error
ISE	Integral of Squire Error
ITSE	Integral Time Weighted Squire Error

RT	Rise-time
ST	Settling-time
MP	Peak Overshoot
GM	Gain Margin
PM	Phase Margin
AVR	Automatic Voltage Regulator
STS	Spherical Tank System
NMP	Non-minimum Phase System
MLS	Magnetic Levitation System
RLM	Root Locus Method
AGC	Automatic Generation Control
FPAA	Field Programmable Analog Array
IR	Infra Red
SOM	Symmetrical Optimum
MIGO	MS Constrained Integral Gain Optimization
DE	Differential Evolution
IEMGA	Improved Electromagnetism-Like Algorithm with Genetic Algorithm
IMC	Internal Model Control
ZN	Ziegler-Nichol's
FOILC	Fractional Order Iterative Learning Controller
GUI	Graphical User Interface

List of Symbols

n	Positive Integer
$\Re^{+}$	Positive real Number
z	Fractional power greater than zero
t, T	Time in second
Γ	Gamma function
E_{ς}	Millage-Leffler function
ς, τ	Fractional parameter
υ, m, θ	Order of fraction derivative
w	Angular frequency
L	Laplace of a function
s	Laplace domain
α, σ	Real constant
T_D	Gain coefficient of tilted controller
i, K	Positive integer constant
K_P	Proportional gain constant
K_I	Integral gain constant
K_D	Derivative gain constant
λ	Fractional power of integral term
μ	Fractional power of derivative term
e	Error
β	Second level of hierarchy of the grey wolves
δ	Third level of hierarchy of the grey wolves
k	Initialization of summation
∞	Infinite
w_b	Lower frequency bound
w_h	Higher frequency bound

b_m	Coefficient of numerator polynomial in generalized fractional order transfer function
a_n	Coefficient of numerator polynomial generalized fractional order transfer function
$U(s)$	Laplace transform of Input in fractional order transfer function
$Y(s)$	Laplace transform of output in fractional order transfer function
E, F	Input matrix in state-space representation of fractional order system
G, H	Output matrix in state-space representation of fractional order system
ψ	Represents a plane
ϕ	Angle in $\psi -$ plane
π	Angle in radians
$\mathrm{R_e}$	Real axis
$\mathrm{I_m}$	Imaginary axis
v_n	n^{th} vertex of simplex
$v_{centroid}$	Vertex of centroid
$v_{reflect}$	Reflected vertex
l	Coefficient of reflection
ρ	Coefficient of expansion
∂	Coefficient of contraction
η	Coefficient of shrinking