

List of Nomenclature

Symbol	Description	Unit
δ	Skin depth or penetration depth.	[mm]
μ	Magnetic permeability.	[H/m]
μ_r	Relative magnetic permeability.	[H/m]
μ_0	Permeability of free space.	[H/m]
ρ	Electrical resistivity.	[Ω .m]
f	Applied frequency at the work-piece.	[Hz]
J	Current density.	[A/m]
σ	Electrical conductivity.	[S/m]
α	Temperature coefficient for the material.	[-]
I_s	Surface current.	[A]
c	Specific heat	[J/Kg.K]
I_x	Current at distance x	[A]
T	Temperature	[$^{\circ}$ c]
T_{ph}	phase difference time	[s]
T_{on}	Turn on time of PDM	[s]
T_{off}	Turn off time of PDM	[s]
f_{clk}	pulses with high frequency	[Hz]
Q_{th}	Thermal energy	[kW/hr]
M	Mass of the work piece	[Kg]
η_{el}	Electrical efficiency	[-]
η_{th}	Thermal efficiency	[-]
A_g	The air gap cross section area	[m ²]
A_w	The work-piece cross section area	[m ²]
D_c	The diameter of the work piece	[m]
l_c	The work-coil length	[m]
Z	Load impedance	[Ω]
R_w	Work-piece resistance	[Ω]
R_c	Work-coil resistance	[Ω]

X_w	Work-piece reactance	[Ω]
X_c	Work-coil reactance	[Ω]
X_g	Gap reactance.	[Ω]
X_L	Load inductive reactance.	[Ω]
X_c	Load capacitive reactance.	[Ω]
R_p	Equivalent resistance for parallel resonance.	[Ω]
X_p	Equivalent reactance for parallel resonance.	[Ω]
R_L	Load equivalent resistance.	[Ω]
δ_c	Coil current penetration depth.	[mm]
f_r	Resonant frequency.	[Hz]
L_p	Load inductance	[H]
C_t	Tank circuit capacitance	[F]
Q_p	Parallel resonance quality factor.	[-]
f_c	Critical frequency.	[Hz]
v_{inv}	Inverter voltage	[V]
i_{inv}	Inverter current	[A]
M	Modulation index.	[-]
D	Pulse density.	[-]
τ	Time constant.	[s]
f_s	Switching frequency	[Hz]
L_f	Filter inductance	[H]
C_f	Filter capacitance	[F]
L_c	Critical filter inductance	[H]
f_i	input source frequency	[Hz]
θ_{ref}	Reference phase angle	[Deg.]
θ_{act}	Actual phase angle	[Deg.]
P_{ref}	Reference (desired) system power	[kW]
P_{act}	Actual system power	[kw]
L_c	Series commutating inductor	[H]
C_c	Series commutating capacitor	[F]
C_s	Snubber capacitor	[F]
R_s	Snubber resistance	[Ω]

List of Abbreviations

PDM	Pulse Density Modulation
PSC	Phase Shift Control
PWM	Pulse Width Modulation
AFC	Automatic Frequency Control
PFM	Pulse Frequency Modulation
DCC	Duty Cycle Control
PLL	Phase Locked Loop
DCM	Discontinuous Conduction Mode
AVC	Automatic Voltage Cancellation
FV	Frequency Variation
VCO	Voltage Controlled Oscillator
PFB	Power Feedback
PD	Phase Detector
CSI	Current Source Inverter
RMS	Root Mean Square
DC	Direct Current
AC	Alternating Current
GTO	Gate Turn Off Thyristor
PRC	Parallel Resonant Converter
SRC	Series Resonant Converter
ZVS	Zero Voltage Switching
ZCS	Zero Current Switching
IGBT	Insulated Gate Bipolar Transistor
SCR	Silicon Controlled Rectifier
BJT	Bipolar Junction Transistor
THD	Total Harmonic Distortion
EMF	Electromagnetic Force
EMI	Electro Magnetic Interference
ROM	Read Only Memory
PI	Proportional Integral

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