
List of Symbols

Symbols	Details
E	Electric field
H	Magnetic field
k	Wavenumber
γ_o	Relativistic mass factor
β_ϕ	Phase propagation constant
$I_{Charging}$	Charging current
I_{anode}	Anode current
$I_{Critical} / I_{cr}$	Critical current
I_{spoke}	Spoke current
I_b	Beam current
$I_{cathode} / I_c$	Cathode current
I_{escape}	Escape current
I_z	Axial current
I_p	Parapotential current
I_t	Total anode current
I_{beam}	Beam current
ϵ_0	Permittivity of free-space
μ_0	Permeability of free-space
s	Circuit periodicity
η	Power conversion efficiency
m_0	Mass of electron at rest
v_ϕ	Phase velocity
d	Cavity depth
N	Number of cavities
F_m	Magnetic Force
F_e	Electric force
B_θ	Azimuthal self-magnetic field
E_{local}	Localized electric field
U_0	Field enhancement factor
T_{max}	Maximum temperature

ρ	Electrical resistivity
T_e	Electron temperature
n_e	Electron density
ω_D	Diocotron frequency
ω_c	Cyclotron angular frequency
B_c	Critical magnetic field
μ_r	Relative permeability
V_H	Hull voltage
B^*	Hull magnetic field
V_{BH}	Buneman-Hatree voltage
L_{SE}	Length of surface emission part at the cathode
μ	Perveance
r_c	Cathode radius
r_a	Anode radius
r_i	SWS vane inner radius
J	Current density
L_{col}	Length of collector over cathode
r_o	SWS vane outer radius
w	Thickness of SWS vane
A	Field constant
J_0	Zero th -order Bessel function of the first kind
J'_0	Derivative of the zero th -order Bessel function of the first kind with respect to argument
A_n^I	n^{th} space-harmonic field constant in region I
$M_{n,m}$	Dimensionless function involving propagation constants and structure parameters as defined in equation (4.4)
γ_n	n^{th} space-harmonic radial propagation constant
γ_1^{II}	Fundamental stationary-wave radial propagation constant in region II
γ_m^{II}	m^{th} stationary-wave modal harmonic radial propagation constant in region II
β_n	n^{th} space-harmonic axial phase propagation constant
β_n^I	n^{th} space-harmonic axial phase propagation constant in region I
n	Space harmonic number
m	Modal harmonic number
P_t	Power transmitted

D_{nm}	Dimensionless function involving propagation constants and structure parameters as defined in equation (4.4)
Q_{nm}	Dimensionless function involving propagation constants and structure parameters as defined in equation (4.4)
V_b / V_0	Beam voltage
v_d	Drift velocity of electrons
r_{ch}	Radius of choke vane
r_{c2}	Radius of cathode support rod
z	RF interaction gap
l	Free space gap between anode to cathode
φ	Phase difference between the adjacent cavities
ω_{ok}	Resonant frequency of the coupled cavity stack
ω_o	Resonant frequency of an individual SWS cavity
L_{Cmin}	Minimum length of load
r_{ex}	Extractor vane radius
w^a	Inertia weight
$c1$	Cognitive weight
$c2$	Social or Global weight
$r1, r2$	Random numbers on the [0,1] applied to i^{th} particle
F	Fitness function
$f_0\{r, p\}$	Distribution function of RBF
$\eta\{r\}$	Density of the charge particle
\hat{p}_z	Canonical momentum
$\delta\{x\}$	Dirac-Delta function
F_1	Floquet's theorem in perturbed condition
ω_p	Plasma frequency
$\delta\omega$	Frequency shift due to the insertion of object into the cavity
$x_i(t)$	Current position of i^{th} particle at time t
$x_i(t+1)$	Position of i^{th} particle at time $t+1$
$v_i(t)$	Current velocity of i^{th} particle at time t
$v_i(t+1)$	Velocity of i^{th} particle at time $t+1$
$p_i(t)$	Best position found by i^{th} particle at time t
$p_g(t)$	Best position found by swarm at time t

Abbreviations

Abbreviation	Details
HPM	High power microwaves
BWO	Backward wave Oscillator
Vircator	Virtual cathode oscillator
MILO	Magnetic insulated line Oscillator
TWT	Travelling wave tube
SWCA	Slow wave cyclotron amplifier
CFA	Crossed-field amplifier
MWCG	Multi-wave Cherenkov generator
RDG	Relativistic diffraction generator
LINACs	Linear accelerators
GMBK	Giga-watt multi-beam klystron
FEL	Free electron laser
CARM	Cyclotron auto-resonance maser
DEW	Directed energy weapon
RBF	Relativistic brillouin flow
MITL	Magnetically insulated transmission line
HT	Hard-tube
SWS	Slow wave structure
PSO	Particle swarm optimization
ANN	Artificial neural network
NRL	Naval research laboratory
PIC	Particle-in-cell
FDTD	Finite-difference time-domain
FIT	Finite integration technique
FEM	Finite element method
GA	Genetic algorithms
BP	Back propagation
SA	Simulated annealing
TS	Tabu search
PEC	Perfect electric conductor
DUT	Device under test
SOLT	Short open load test
TRL	Through reflect line
KALI	Kilo ampere linear injector