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User Manual of orbit following code TASK/OB

Contents

The purpose of TASK/OB is to describe charged particle orbits in a given magnetic configuration. At present, gyro orbits in the Boozer coordinates are described based on the textbook by R. White. More general coordinates including vacuum regions and full orbit description will be included in future.

obcomm_parm	Deficnition of input parameters
obcomm	Definition of common variables
obinit	Initialization of input parameters
obparm	Procedures of input parameters (read, check, broadcast)
obview	Print out input parameters
obmenu	Command menu
obprep	Preparation for calculation (equilibrium, interpolation)
obcalc	Calculation of coefficients
obexec	Solving equation of motion
obgout	Visualization of orbits
obfile	File output of orbits
obsub	Common subroutines using obcomm
oblib	Common subroutines independent of obcomm

nobt_m	100	maximum number of orbits

modelg	3	geometry model (parameter of plparm)
nobt_max	1	number of orbits
nstp_max	10000	maximum number of orbit step
ns_ob	2	id of particle species
lmax_nw	20	maximum number of iteration (initial condition)

mdlobp	0	model id of equation of motion 0: Eq of Motion with Boozer coordinates 1: Eq of Motion with Cylindrical coord.
mdlobi	0	model id of input scheme of initial parameters 0: penergy,pcangle,zeta,psipn,theta 1: penergy,pcangle,zeta,rr,zz (TBI) 100: line input with psipn,theta 101: line input with rr,zz (TBI)
mdlobq	0	model id of ODE solver 0: 4th-order Runge-Kutta-Gill 1: universal ODE solver (TBI) 2: symplectic solver (TBI)
mdlobt	1	model id of time normalization 0: real time 1: normalized by approximate bounce time
mdlobc	0	model id of one cycle calculation 0: independent of cycle, until tmax_ob 1: one cycle for trapped and untrapped
mdlobw	3	model id of output interval 0: no output 1: every step 2: every 10 step 3: every 100 step 4: every 1000 step 5: every 10000 step
mdlobg	0	model id of graphics 0: default
mdlobx	1	model id of wall 0: calculate only inside the wall (psip_ob¡=psipa) 1: continue Runge-Kutta (psip_ob¿psipa)
tmax_ob	10.D0	maximum of orbit following time in omega_bounce
delt_ob	0.1D0	time step size in omega_bounce t_bounce = 2 Pi/ omega_bounce omega bounce = (v_perp/qR) SQRT(r/2R) omega_bounce^2 = (mu B /m)*(r/q^2 R^3)
eps_ob	1.D-6	convergence criterion of orbit solution
del_ob	1.D-4	step size of iteration (initial condition)
eps_nw	1.D-6	convergence criterion of iteration (initial c.)
penergy_ob_in(1)	1.D0	initial particle energy (mdlobi=0,1) [keV]: conserved
pcangle_ob_in(1)	0.5D0	initial cosine of pitch angle (mdlobi=0,1)
zeta_ob_in(1)	0.D0	initial toroidal angle (mdlobi=0,1) [degree]
psipn_ob_in(1)	0.5D0	initial normalized poloidal flux (mdlobi=0)
theta_ob_in(1)	0.D0	initial poloidal angle (mdlobi=0) [deg]
rr_ob_in(1)	4.D0	initial major radius (mdlobi=1) [m]
zz_ob_in(1)	0.D0	initial vertical position (mdlobi=1) [m]
nrmax_ob	100	number of equilibrium radial meshes
nthmax_ob	64	number of equilibrium poloidal meshes
nsumax_ob	100	number of equilibrium plasma boundary meshes

2.3 Initial orbit parameters and results

- Initial orbit parameters: (nobt)

penergy_ob_in(1)	initial particle energy (mdlobi=0,1) [keV]
pcangle_ob_in(1)	initial cosine of pitch angle (mdlobi=0,1)
zeta_ob_in(1)	initial toroidal angle (mdlobi=0,1) [degree]
psipn_ob_in(1)	initial normalized poloidal flux (mdlobi=0)
theta_ob_in(1)	initial poloidal angle (mdlobi=0) [deg]
nthmax_ob_in(1)	number of equilibrium poloidal meshes
nsumax_ob_in(1)	number of equilibrium plasma boundary meshes

- Initial variables: (nobt)

zetab_pos	toroidal boozer angle zeta translated from obts
thetab_pos	poloidal boozer angle theta
psip_pos	poloidal magnetic flux
rhopara_pos	parallel velocity devidede by cyclotron freq.

- Orbit results: (nstp,nobt)

nstp_max_nobt	number of steps for nobt
time_ob	time
zetab_ob	toroidal boozer angle zeta translated from obts
thetab_ob	poloidal boozer angle theta
psip_ob	poloidal magnetic flux
rhopara_ob	parallel velocity devidede by cyclotron freq.
pzeta_ob	toroidal momentum pzeta
ptheta_ob	poloidal momentum ptheta
babs_ob	absolute value of magnetic field
phi_ob	electrostatic potential
vpara_ob	parallel velocity
vperp_ob	perpendicular velocity
psit_ob	toroidal magnetic flux
zeta_ob	toroidal angle
rr_ob	major radius
zz_ob	vertical positon
rs_ob	minor radius
theta_ob	poloidal angle