

Contents

1	Space Geometry	1
1.1	Definition	3
1.2	Triple integral	7
1.2.a	Preamble	7
1.2.b	Parametric equation of ellipsoid	8
1.2.c	Intersection ellipsoid and plane	9
1.2.d	Envelope	11
1.2.e	Domaine for triple integral	13
1.2.f	Vshade	15
1.2.g	Representation of the integral	16
1.2.h	Calculus integral	18
1.3	Helix	19
1.4	Distance of wo straight lines	21
1.5	Examples of curves	24
1.6	Parallelepiped	32
1.7	Space rotation	35
1.7.a	Preamble	35
1.7.b	Composition of rotations	36
2	Using cavalier perspective	41
2.1	Programs Python for cavalier perspective	41
2.1.a	Utilities	43
2.1.b	Program C_curve_arc_ABC.py	54
2.1.c	Direct calculs of a , b and α	60
2.1.d	Case $b \simeq 0$	64
2.2	Arrowed arc	67
2.2.a	Example	67
2.2.b	Theory for arrowed arc	70
2.2.c	Exercices :	73
2.3	Intersection of a right circle cylinder and a plane	79
2.4	Right angles for orthogonal curves	81
2.4.a	Macros \right	82
2.4.b	Preamble	84
2.4.c	Right space : Equator and meridian	85
2.4.d	Rhombus for two arcs of circles	88
2.5	Envelope	93
2.6	Lat and lon for known U and V	96
2.7	Curve visible or hidden	100
2.8	Intersection of sphere and plane	104
2.8.a	Case two points A , B and d	104
2.8.b	Case P intercept Σ	108

3	Descriptive Geometry	123
3.1	Preamble	123
3.2	Traces of plane or straight line	126
3.2.a	Traces of straight lines	126
3.2.b	Traces of plane defined by two straight lines	128
3.2.c	Traces of horizontal straight line	129
3.2.d	Traces of plane defined by horizontal and frontal lines	131
3.3	Exercices	132
3.3.a	Distance from a point to a plane in space	134
3.3.b	Perpendicular to two straight lines	141
3.3.c	Projection of a circle	147
3.3.d	Projection of a any circle	149
4	Euler and earth angles	155
4.1	Euler angles	155
4.2	Earth coordinates to Euler angles	163
4.2.a	Example 1 :	165
4.2.b	Example 2 :	167
4.2.c	Preamble	170
4.2.d	First approach	170
4.2.e	Second approach	173
4.3	Euler angles to earth coordinates	186
5	Spherical trigonometric formulas	199
5.1	Vshade for spherical triangle	200
5.2	First method	203
5.3	Second method	208
5.4	Third method	212
6	Sun perspective	221
6.0.a	My Sun declinaison	222
6.0.b	Modern calculus	226
6.1	Theory of Sun perspective	227
6.1.a	Parameter of affinity	228
6.1.b	Equation of a circle of the terrestrial sphere	229
6.1.c	Arctic circle and sun Earth	231
6.2	Files Python used in Sun perspective	235
6.2.a	Constants	235
6.2.b	Program S_curve_arc_ABC	235
6.2.c	Curve visible or hidden	237
6.2.d	Lat Lon with X Y	243
6.2.e	Rhombus	250
6.3	Examples of introduction	254
6.3.a	Program Sun_plane_circle_arc	254
6.3.b	Example 1 :	259
6.3.c	Example 2 :	263
6.3.d	Example 3 :	266
6.3.e	Complete example	268
6.4	Viviani's window	273

7 Use Sun perspective	279
7.1 Circles of earth	279
7.1.a Case $G_A = G_B$	279
7.1.b Case $L_A = L_B \neq 0^\circ$	284
7.1.c Case $G_B < G_A$ and $(L_A > L_B$ or $L_A < L_B)$	289
7.2 Spherical triangle	294
7.2.a hshade	295
7.2.b Earth and spherical triangle	303
8 Infinity perspective	305
8.1 File Python used in infinity perspective	308
8.1.a Contants and utilities	308
8.1.b Mains programs	311
8.2 Parallel	318
8.3 Meridian	322
8.4 Any great circle of earth	324
9 Eye perspective	335
10 Astronomic navigation	343
10.1 Introduction	343
10.1.a Sun, Waves and Yacht	343
10.1.b Solar coordinates	345
10.1.c Length of curve (complement)	350
10.1.d Greenwich meridian	352
10.1.e Yacht in morning	353
10.1.f Yacht in afternoon	363
10.2 Astronomical navigation	367
10.2.a Line position by use a sextant observation	367
10.2.b Sumner line	369
10.3 Lines of position	374
10.4 Calculus for astronomic navigation	378
10.4.a Genesis	381
10.4.b Astro_utilities	383
10.4.c Julian Day	384
10.4.d Sideral time	385
10.4.e Inclinaison sur l'ecliptique	387
10.4.f Coordinates of Sun	388
10.4.g Right ascension and declinaison	388
10.4.h Sextant	388
10.4.i Program astro_meeus.py	390
10.4.j Calculus table	394