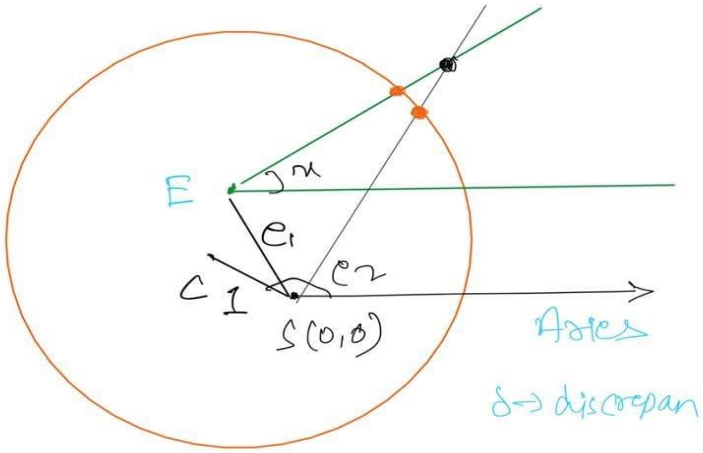
Lubhawan Parihar | SR.No.: 06-18-01-10-51-21-1-19239

E0 259 Data Analytics 2022

Assignment -2 (MARS)

Q.1.

- Let D be dotted line angle from Aries,
- (Cx,Cy): Centre of Orbit Cartesian Coordinate (C)
- (Ex,Ey): Equant Cartesian Coordinate from (E1,E2)



Solving Equations

$$(X^2 - Cx^2) + (Y^2 - Cy^2) = R^2$$
$$Y - Ey = (X - Ex) * tanD$$

Simplifying above equation to 2nd Order Equation and solve it

$(1 + (tanD)^2)\, X^2 + (-2Cx + 2tanD(Ey - Cy - Ex * tanD)X + (Ey - Cy - Ex * tanD)^2 + Cx^2 + R^2 = 0$

Solving for roots and get X1, X2 and using 2 to get Y1, Y2.

By determining which XY quadrant the Dotted Line Angle lies in (First and Fourth Quadrant X1 >0 and opposite in Third and Second), we can eliminate one of the points.

Q.2.

Optimized initial values used:

Grid Search Method with One Parameter Varying Over Range by Maintaining Fix Used

Optimized Method Used by SciPy Method

Based on the Error value incrementing parameters differently

- If Error>=100:

  Increment is define by z -(0,360) if its Exhaust than Next (C, E2) -((0,360),(0,360)) than E2 Varies (1,0.5*r)

- If 10<=Error<=100:

  To check that the conversion is finite, increment is defined by altering Cf & E2f.

- If 0.3<=Error<=10:

  Passing Same Optimize Value to Optimize function And Checking Divergence Value(fun(Second Last Max Error)-result.fun(Last Max Error)).

Q.3.

Each Si range is divided into a predetermined number of points (Precision). after that iterating to locate the lowest MaxError.

Q.4.

Calculation Rf:

1. Solving Equation Y=X *tan(actuacl_angle) and (Y-Ey)=(X-Ex) *tan(DottedLineAngle) X=(ey - ex * tan(Stroke)) / (tan(Act_Line) - tan(Stroke)
2. New_Rf= is mean of each distance between (X,Y) and (Cx,Cy)

Flow of search:

- Iteratively finding new r until error start increasing.
- Divergence condition and updation:
  - r decreasing then break internal loop and increment in c by step size.
  - If r increasing exponentially then break internal loop and decrement in c by step size.
- Final r corresponds to min MaxError.

Q.5.

Concurrently using BestS and BestR iteratively until either of the following conditions are satisfied

1. MaxError < 4’
2. Difference between MaxError of two consecutive iterations remains constant or is positive(error increased). Can’t converge more.

OUTPUT:

```
Fit parameters: r = 8.53, s=0.51 , c =150.2, e1 = 1.62, e2 = 93.33, z = 55.9311
The maximum angular error = 0.0902 and degree = 5.412 minutes
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Maximum angle error = 0.0902° = 5.412’