

# PHYS:5905 Homework 2

Chuan Lu

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1. Larmor Motion in constant, uniform magnetic field with zero electric field.
  - (a) Figure 1 shows the plots of  $x(t)$ , where the numerical solution is computed with  $N = 2000$  timesteps:
  - (b) Figure 2 is the error plot with respect to the number of timesteps. The slope is  $k = -1.00393$ .
2.  $E \times B$  drift in a constant, uniform magnetic and perpendicular electric field.
  - (a) Figure 3 shows the plots of  $x(t)$ , where the numerical solution is computed with  $N = 2000$  timesteps:
  - (b) Figure 4 is the error plot with respect to the number of timesteps. The slope is  $k = -1.00389$ .

We notice that the slopes in both problems are just the same when the number of timesteps  $N$  is large enough. This shows that the forward difference method is asymptotically linear.

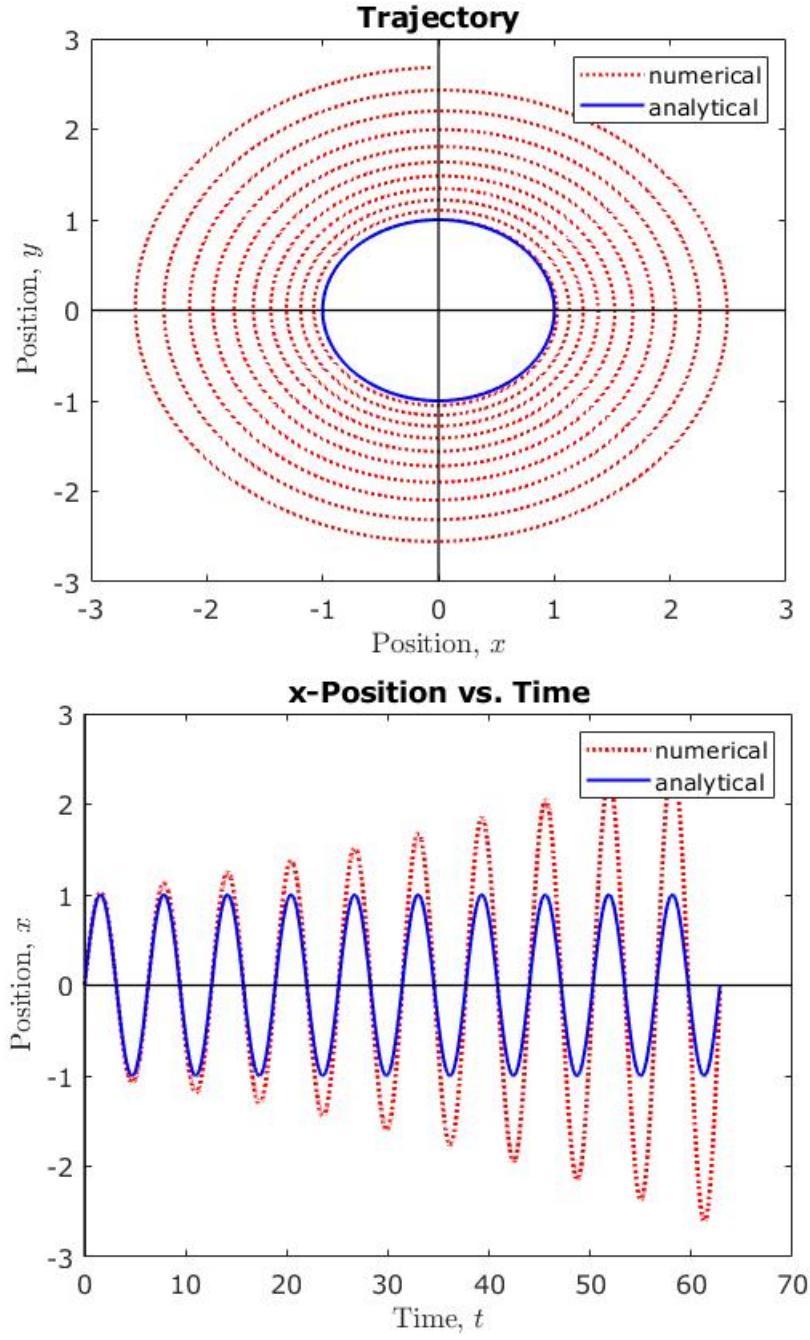


Figure 1: The trajectory in the  $(x, y)$  plane (top) and the position  $x$  as function of time  $t$  (bottom). The dot lines are numerical solutions solved with  $N = 2000$  timesteps and the solid lines are the analytical solutions.

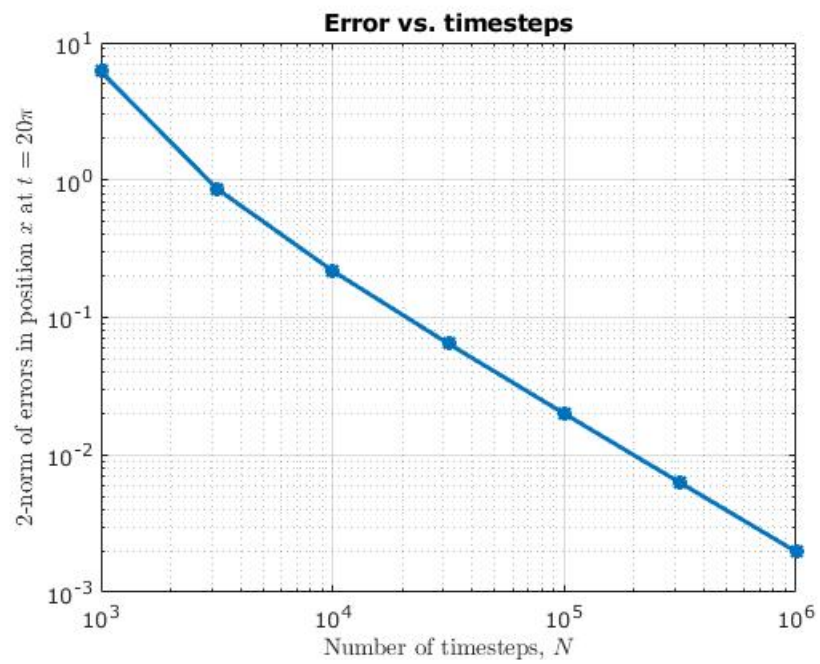


Figure 2: The error at  $t = 20\pi$  with respect to the number of timesteps  $N$ .

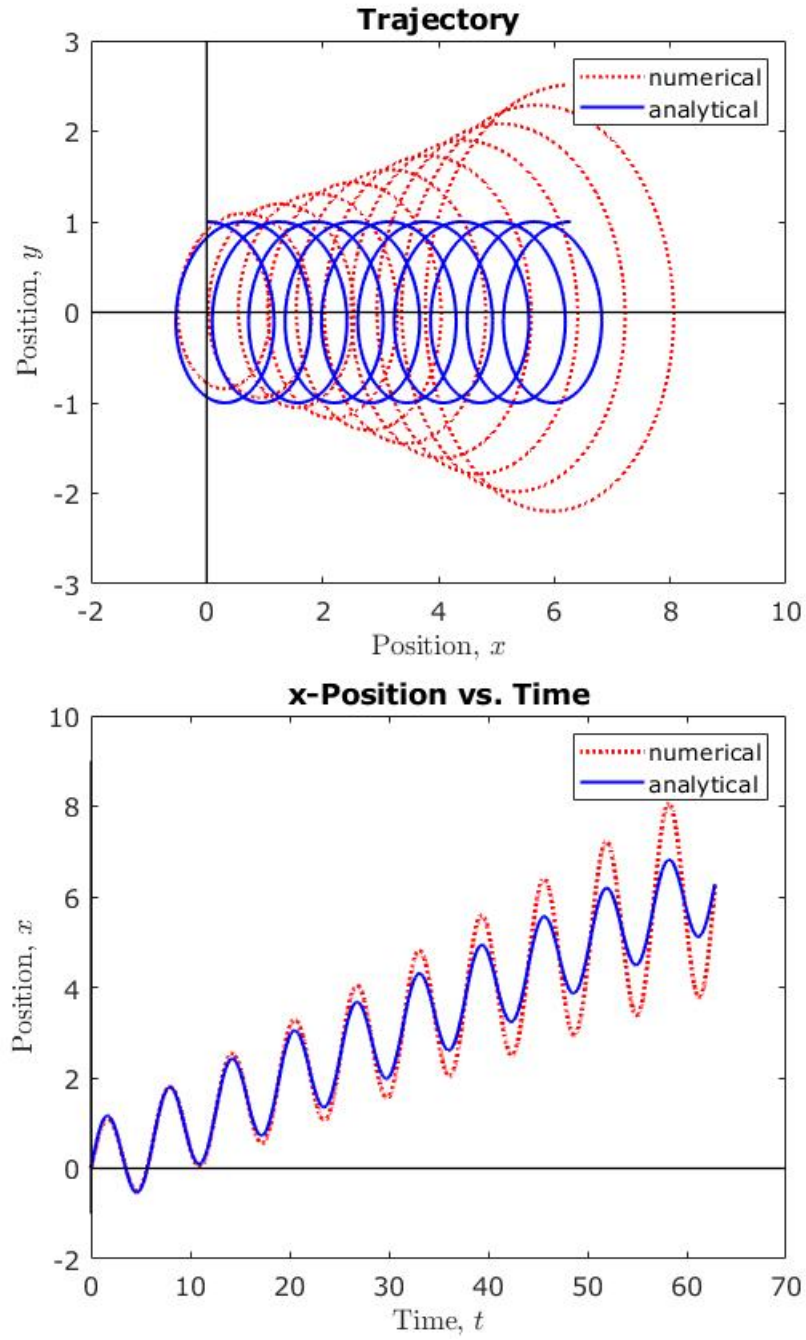


Figure 3: The trajectory in the  $(x, y)$  plane (top) and the position  $x$  as function of time  $t$  (bottom). The dot lines are numerical solutions solved with  $N = 2000$  timesteps and the solid lines are the analytical solutions.

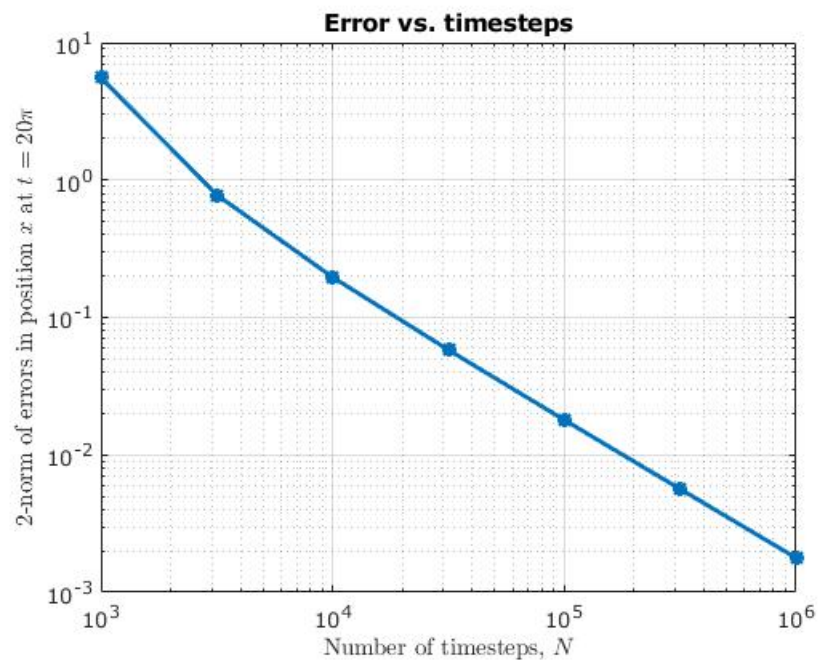


Figure 4: The error at  $t = 20\pi$  with respect to the number of timesteps  $N$ .