

## EAS Ocean Modeling | Homework #1 Coriolis



### Part A

Below are the equations for inertial motion (see chapter 2 of Cushman-Roisin).

$$\begin{aligned}\frac{du}{dt} - fv &= 0 \\ \frac{dv}{dt} + fu &= 0\end{aligned}$$

1. Solve the equations numerically in MATLAB using the following schemes: Euler forward, Euler implicit and a centered scheme. Plot and compare the numerical solutions to the analytical solution, and discuss the differences between the schemes (e.g. stable vs. unstable vs. conservative).
2. Make a plot of the trajectories  $[x(t), y(t)]$  for the different schemes. Do the trajectories undergo perfect circles? Discuss the result.

### Part B

1. Repeat the same exercise Part A using the Regional Ocean Modeling System. In order to do this you will follow some of the tutorials: <http://www.oces.us/eas-ocean-modeling/ROMS-Tutorial/tutorials.html>. Learn how to login on the training cluster. See **Section 1** of modeling tutorials (note: you need to complete your account request if you have not done it already). Now follow the tutorials of **Section 2 & 3** to get an overview of ROMS code, compiling and running jobs on the cluster, and to learn how to configure the inertial oscillation example.
2. Now repeat this problem but add a mean background velocity to the equation of motion. How do the trajectory change?
3. Now repeat this problem with no background velocity but some diffusion on the equations of motion. How do the trajectory change?