Lab 4: Vector-Field Visualization based on Particle Tracing

Due: Sunday? ?/?, 11:59pm
Lab 4 is graded out of ? points

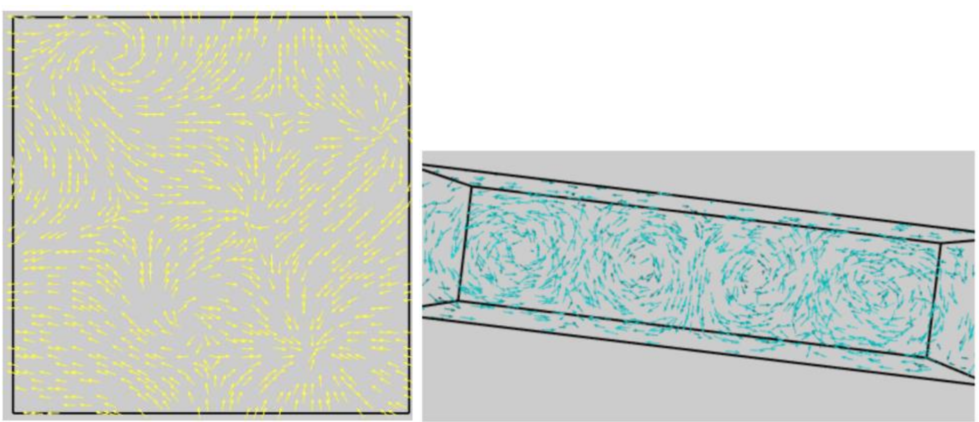
1. Description

The goal of this lab is to get familiar with vector-field visualizations and learn how to trace particles in vector fields. You are required to (1) seed particles inside vector fields, (2) move particles within vector fields using Runge–Kutta methods and tri-linear interpolation, (3) collect particle trajectories and output line-based visualizations.

2. Tasks

In your program,
Input:
    Vector-field data,
    (seeding scheme)
Output:
    A vector-field visualization.

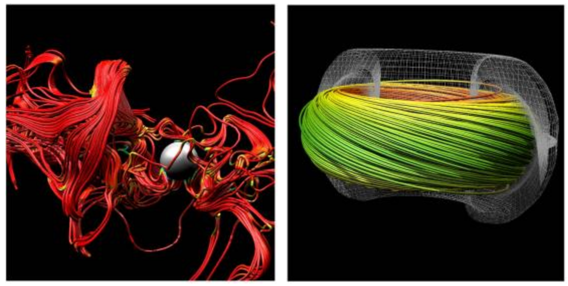
(1) You are required to seed particles inside the domain of the input vector field. Possible seeding schemes are (a) uniform seeding, (2) random seeding, and (3) local seeding.



Arrow representations of input vector fields.

(2) You are required to implement the Runge–Kutta methods to integrate the movements of particles within vector fields. In this step, you need to linearly interpolate vectors at given locations based on the vectors defined on grid points.

(3) You are required to collect the computed particle trajectories and generate line-based vector-field visualizations.



Examples of streamlines.

Documentation - write a README file and a report:
Your report should include high-quality rendering images. Also, please specify the seeding scheme and parameters used for visualization, such as the advection step size and the maximal advection step. You may also discuss the challenges and issues when you complete this lab. Also, you should document how to use your code, making sure the grader can compile and run your codes successfully.

Lab submission:
Under the Lab4 assignment on Carmen, submit your code, the readme file and the report using File Upload option (not the Buckeye Box option).

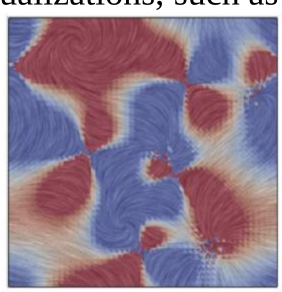
3. GRADING

Lab 4 will be graded out of ? points, based on the following criteria:

- Is the lab submitted in the correct format and following our file naming conventions? (? point)
- Is the output result correct? (? point)
- Does the report demonstrates results of each task clearly? (? point)
- Was a thorough readme file submitted in addition to the lab implementation? (? point)

Bonus

- Generate texture-based visualizations, such as LIC and FTLE.



An example of LIC image.