

EJS Session III – Interactions

Goals for the session:

1. Write an EJS simulation to show how two charged objects interact in one-dimension
2. Modify the simulation to two dimensions
3. Spend some time brainstorming about /working on your own simulation project

1-D interactions (75 minutes)

As usual, you may want to start with an existing program, rather than starting completely from scratch.

Level 1 goals (everyone should achieve these):

- Define a list of relevant variables
- Put in the relevant equations and/or constraints
- Create a View that shows two charged objects interacting as you drag them left or right – a good way to show the interaction is to attach force arrows to the charges

The force each charge experiences is given by: $F = \frac{kq_1q_2}{r^2}$

Level 2 goals (most of you should achieve these)

- Add features so that the User can interact with the simulation to change parameters (such as the charges of the objects)
- Make sure the simulation works correctly for all positions
- Enable the simulation to evolve properly with time
- (add your own)

Level 3 goals (probably only a few of you will achieve these tonight):

- Add relevant graphs to show force and/or energy
- Expand to three or more charges
- (add your own)

Note: The example program ParticlesandWalls.xml is a useful model to look at, although there is a lot going on!

2-D interactions (45 minutes)

Starting with your previous simulation, modify it to work in two dimensions.

Level 1 goals (everyone should achieve these):

- Put in the relevant equations and/or constraints
- Modify the View to represent the 2-D interactions

The challenge here is to do the x and y components properly.

$$F = \frac{kq_1q_2}{(x_2 - x_1)^2 + (y_2 - y_1)^2} \quad F_x = \frac{kq_1q_2}{(x_2 - x_1)^2 + (y_2 - y_1)^2} \times \frac{(x_2 - x_1)}{\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}}$$

Level 2 goals (some of you should achieve these):

- Enable the simulation to evolve properly with time

Level 3 goals (probably only a few of you will achieve these tonight)

- Add more charges

Your own simulation project (30 minutes)

Come up with an idea for a single simulation or a set of simulations.

What principles of physics are involved?

What will make your simulation unique?

How will the User interact with the simulation?

How are you going to implement your simulation? Lay out your level 1 goals (the minimum you would like to achieve), your level 2 goals (add a few more features), and your level 3 goals (something more challenging that would make the simulation really interesting).