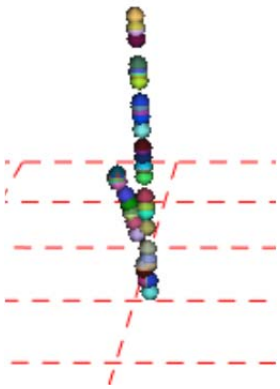
EECS 287 Project 1 - Physics

In this project you will implement a physics-based animation scenario of your choice. Your project will be based on a particle system and you will also perform a benchmark.

Requirements:

1. Your simulation will contain examples with **many particles** (hopefully like hundreds) and you will have to produce an interesting physics-based simulation environment.
2. You will use **spring forces to maintain a particle-based structure**, like a cloth model, a rope, etc.
3. You will include **collision detection and reaction**, which can be implemented with spring reaction forces or another method.
4. You will implement **at least 2 different solvers** in order to compare the achieved results with each one.
5. You will perform **benchmarks** comparing the two solvers.



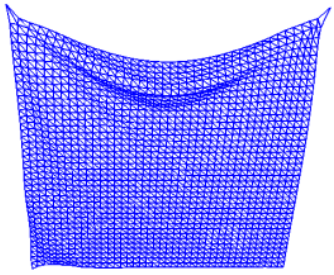
Examples of scenarios that can be implemented are:

- balls being thrown through a deformable basketball net,
- a tennis racket with strings that visibly deform when interacting with many bouncing balls of different weights and sizes,
- a large deformable net catching and bouncing balls falling on it,
- a simulation of the Newton's Cradle (with examples with many spheres),
- etc.

Some notes:

- If you want to develop a deformable mesh with realistic appearance using GsModel you will need to regenerate normal vectors every time the vertices of the polygons change. You may re-generate the V and N arrays in GsModel at every frame, or you may also create your own scene node with your specific solution to improve efficiency. It is also ok to just display your structure in wireframe, in which case you do not need normal vectors and you could even use SnLines instead of SnModel.

- Recall that the "geometric constraint enforcement" procedure will be much more stable for maintaining stiff springs, in particular for cloth simulation.



The grading of the project will be computed as follows:

70% - basic requirements and overall quality of your project,
15% - how well your benchmark was designed and performed,
15% - your report (see specific report instructions below).

The Report: The report is a **1-page report** in the format described by the template below. The report will have a few paragraphs, a table, and at least one image. You have to make everything fit in 1 page, which means you have to put in the report only the most relevant/interesting results of your project. You may use any layout (like 2-columns) as long as it fits in 1 page.

Project Title:
Name and email:

1) Numerical Solvers Implemented
Explain here which solvers you have implemented and, based on your implementation and from what you have learned about them, how you would expect them to perform.

2) Benchmarks
Comment here how the solvers compared in terms of speed of computation and stability in your program, using a table similar to Table 1. Explain and illustrate the most interesting aspect(s) of your tests with one or two images (snapshot(s) of your program).

	n=20	n=40	n=60	n=80	…
Solver 1:					…
Solver 2:					…
Comments:	Both produced similar results	Solver 1 produced more realistic results	Solver 2 needed different parameters	Solver 1 Exploded after 10 seconds	…

Table 1 – Make sure the units are correctly given, make sure you correctly measure the computational time of the solvers without including the rendering time; make sure everything in the table is well defined: in our example here we would need to describe exactly what "n" means. You may change the format of the table as much as needed, you just need to present your results in the best possible way. For example, if there are no significant comments per column to make, then do not include the last row.

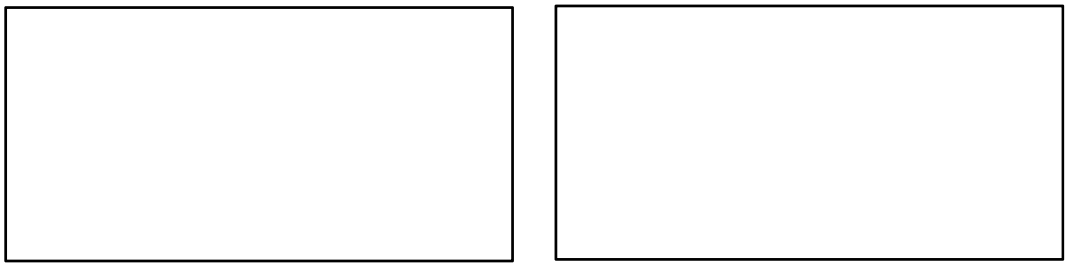


Image 1 – add illustrative image(s) showing your most interesting result(s). You can put the image(s) anywhere and in any layout.

3) Conclusion
Write here the main conclusion(s) you have achieved as a result of analyzing your benchmarks.