CS267 ASSIGNMENT 2: PARALLELIZE PARTICLE

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The box is segmented into subBlockNum number of subBlocks. Each subBlock is represented as a bin in the binArray.

The binArray is a 2D static array data structure, where we allocate binNum number of elements to represent the number of subBlocks in the box.

Each binArray[idx], where 0 ¡= idx ¡ binNum, is a pointer to an array of particlet pointers. Dereferencing binArray[idx][jdx], where 0¡=jdx¡maxN gives a particlet object. We determine the upper bound, maxN using a mathematical argument.

To check if a target particle collides with its neighboring particles, we only check a subset of all n particles. This subset comprises the following:

(1) Particles that belong to the same bin as the target particle
(2) Particles that belong to the left, right, bottom, top, topLeft, topRight, bottomLeft or bottomRight subBlocks with respect to the original subBlock where the target particle is located.

1. Pseudocode for serial.cpp O(n) implementation

Initialize particle binning
for each time step
// Compute forces for each particle in each bin
for each bin
for each particle in current bin Compare with other particles in current subBlock. Compare with other particles in adjacent 8 subBlocks.
// Move particles
// Re-bin particles

2. Serial Code performance

The time needed to run the O(nsquare) serial code takes on average 0.0214294sec for n = 500