A directly Programmed Solution to ARGESIM Comparison 12 "Collision of Spheres using Octave

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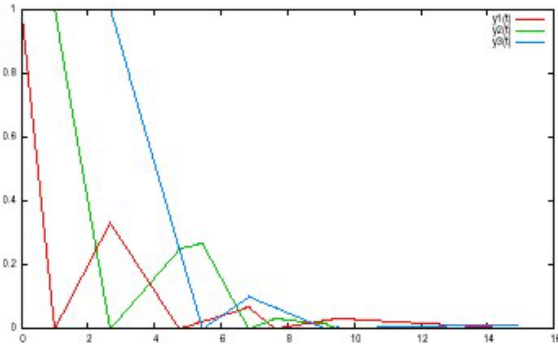
Simulator. Octave is a freely available and redistributable software (http://www.octave.org). It is primarily intended for numerical computations, using a language that is mostly compatible with MATLAB.

Model. The system of differential equations (4) is directly solvable. Therefore an event-discrete approach has been chosen. Determining the point in time of the next collision is done using a simple loop:

```
function [time,num] = next_coll(distance, speed)
t = 1000000;
num = 0;
for i = 1:3
     if speed(i) < 0
         new_t = distance(i) / abs(speed(i));
         if new_t <= t
              num = i;
         end
         t = min(t, new_t);
     end
end
```

Task a1 - Simulation in the time domain. The function `collision_run` takes as parameters the collision coefficient `e`, diameter `d`, initial distance `a` and initial speed v_0. It repeatedly runs next_coll until the termination criterion is met and returns arrays representing the points in time of the collisions and the corresponding absolute distances. The speed between the collisions is linear, so a simple plot gives the result (fig.1).



Task a2 - Final values for the velocities. For `e=1` the final velocities are [0 0 0 1]. The quasi plastic case was found for `e=0.176`, when the maximum of the absolute relative velocities falls below 10^{-9}.

Task b1/b2 – Variation restitution coefficient . Variation from 0.17 to 1 with stepsize 10^{-2} gives fig.2 showing the number of collisions, as well as fig.3 showing the final velocities as a function of `e`.

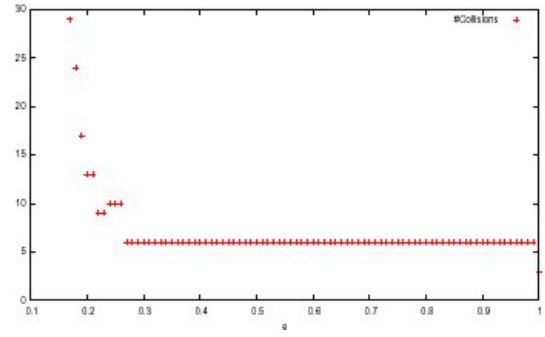


Fig. 2: Number of collisions versus restitution coefficient

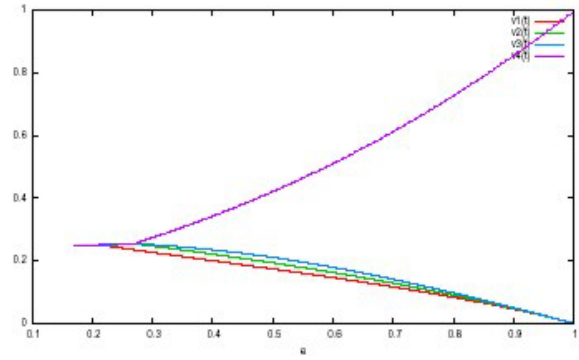


Fig. 3Final velocities of the four spheres versus restitution coefficient

Task c1 - Boundary value problem. This task has been implemented searching for a zero point of the function $v_4 - v_0/2$ using Regula Falsi. It was found for `e=0.5874` using an accuracy of 10^{-6}.

Task c2 - Normal distributed restitution coefficient. The built-in function normal_rnd was used to generate a sample of 2000 values with mean value 0.5 and standard deviation 0,05. The resulting distribution of v_4 is shown in fig.4.

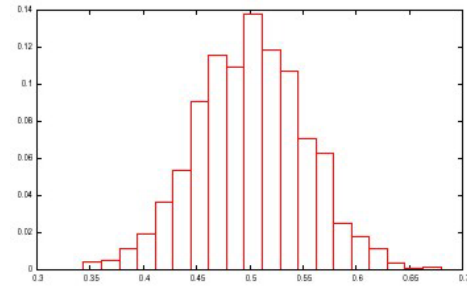


Fig. 4 Histogram of distribution

C12 Classification: Programmed Event Approach

Simulator: Octave Rel. 2004