Formulae

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1 movement

Given a velocity v and a position vector s
We currently $s_{n+1} = s_n + v * t$
We want to use a solver for the DE $v = \frac{\partial s}{\partial t}$

2 acceleration

We currently use $v_{n+1} = v_n + a * t$
We want to use a solver for the DE $v = \frac{\partial^2 s}{\partial t}$

3 force

$a = \frac{F}{m}$

4 collisions

collision on a plane with normalized normal n_u
decompose v into vector u orthogonal to the plane and w parallel to the plane
$u = v * n_u * n_u$
$w = v - u$
compute the outgoing velocity v', considering the coefficient of restitution c_r
and the coefficient of friction c_f
$v' = w * c_f - u * c_r$
computing the force Fc needed to transform v into v'
$F_c = m * \frac{\partial v}{\partial t} = m * fracv' - v\partial t$

5 normal force

Computing the normal force F_n, being the projection of F_g onto the
normalized normal vector n_u of the plane supporting an object
$F_n = F_g * n_u * n_u$