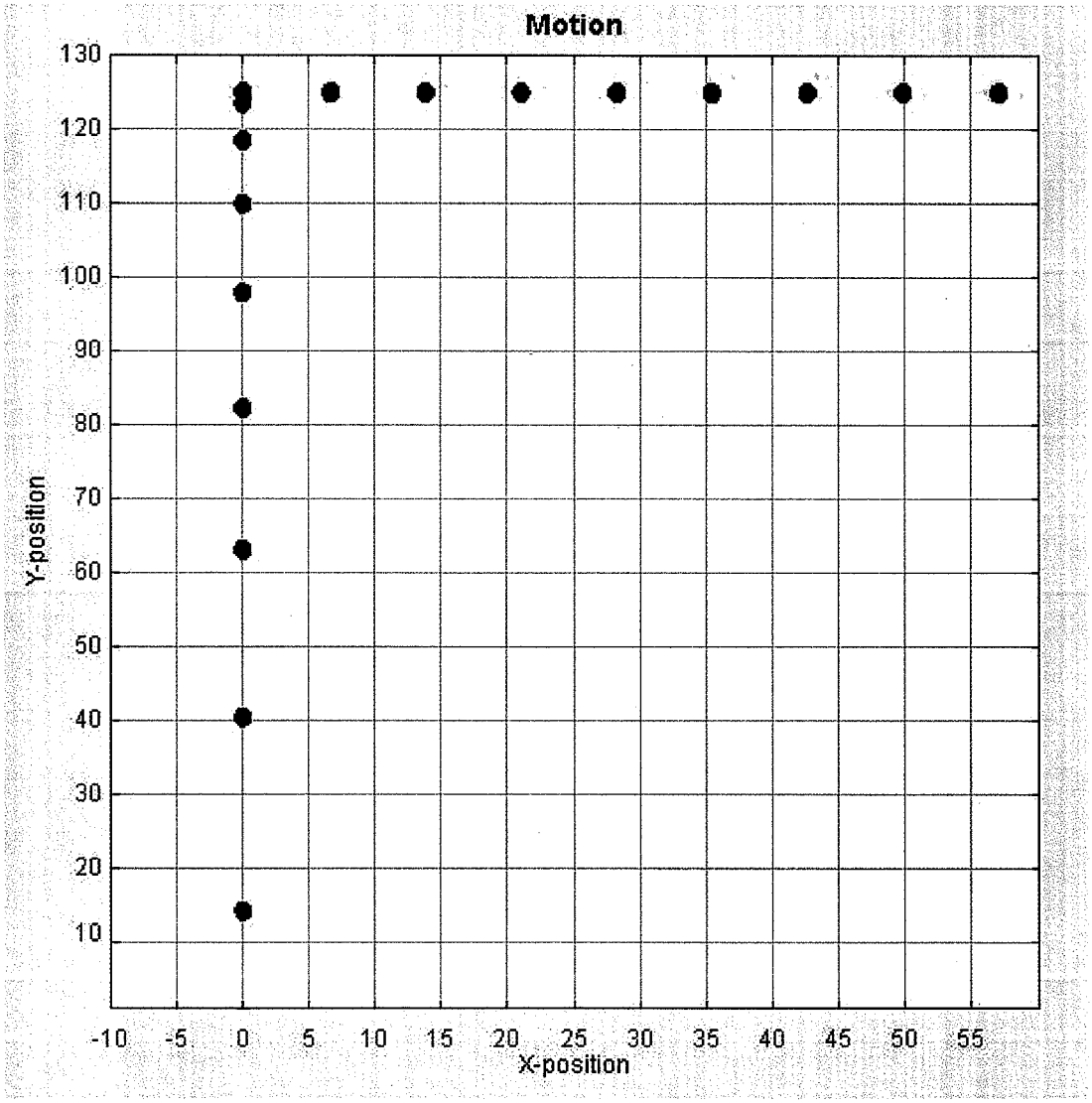
Gail Howe

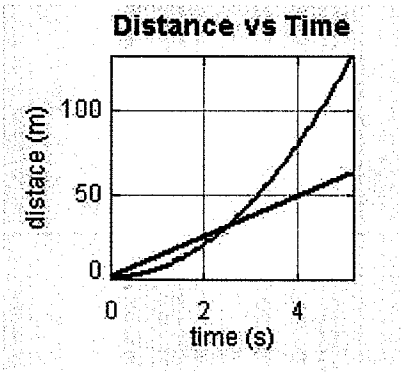
Physics Principles and Simulation Description

For NS548 Final Project

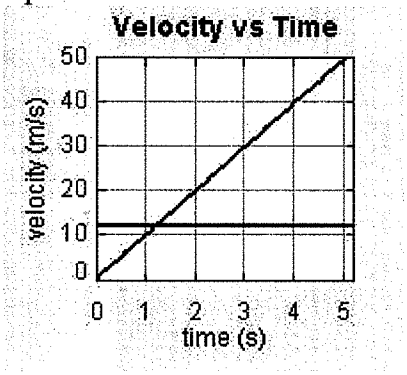
The first simulation, **Motion in Two Dimensions**, shows the horizontal component of projectile motion via a red ball. The position of the red ball is shown at equal time intervals. This emphasizes that the distance traveled during each time interval is equal and therefore the velocity of the object must be constant. The equations used in programming the movement of the red ball are $x = xi + (vxi)(t)$ and $t = t + dt$. The vertical component of projectile motion is described via a blue ball. Here it is shown that the distance traveled during each time interval increases therefore the object must be accelerating. The additional equations used in programming the motion of the blue ball are $vy = vyi - (g)(t)$ and $y = yi + (vyi)(t) - (0.5)(g)(t^2)$. This simulation has play/pause, step, and reset buttons to manipulate.



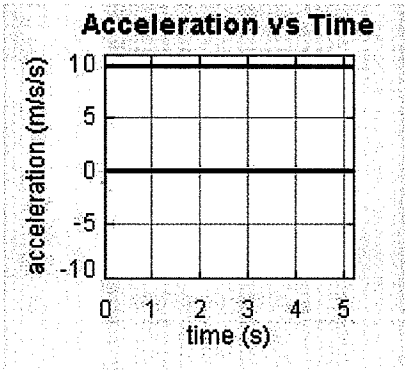
Color coded graphs connect the graphics with the math. The distance verses time graph illustrates that the red line has a constant slope while the slope of the blue line is changing.



The velocity verses time graph illustrates that the red ball has a constant velocity, the value of which can be seen to be the slope of the red line in the previous graph. The blue line has a constant slope the value of which can be seen in the acceleration of the blue ball in the following graph.

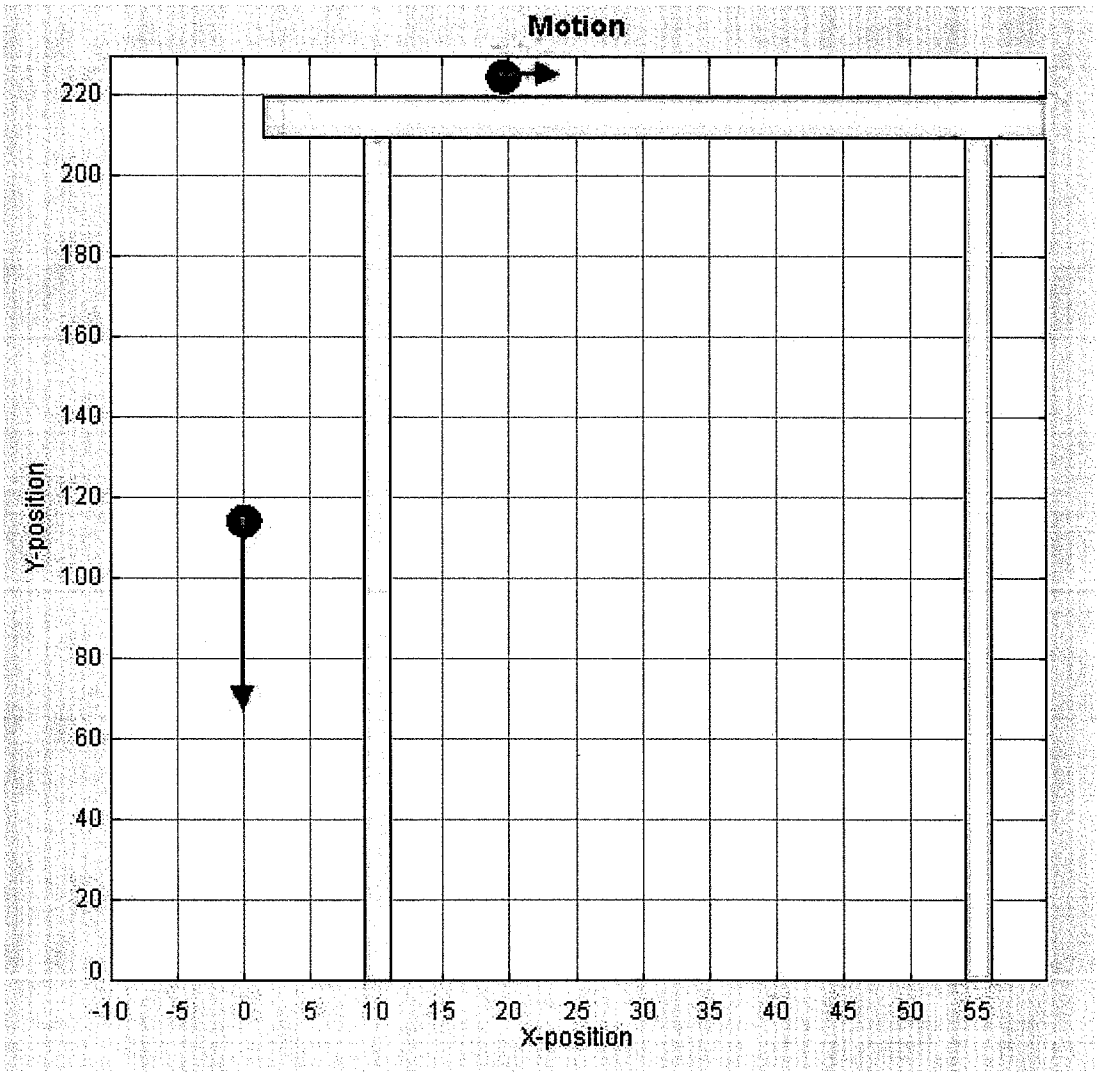


The acceleration verses time graph shows no acceleration for the red ball and a constant acceleration of the blue ball equal to the value of g.

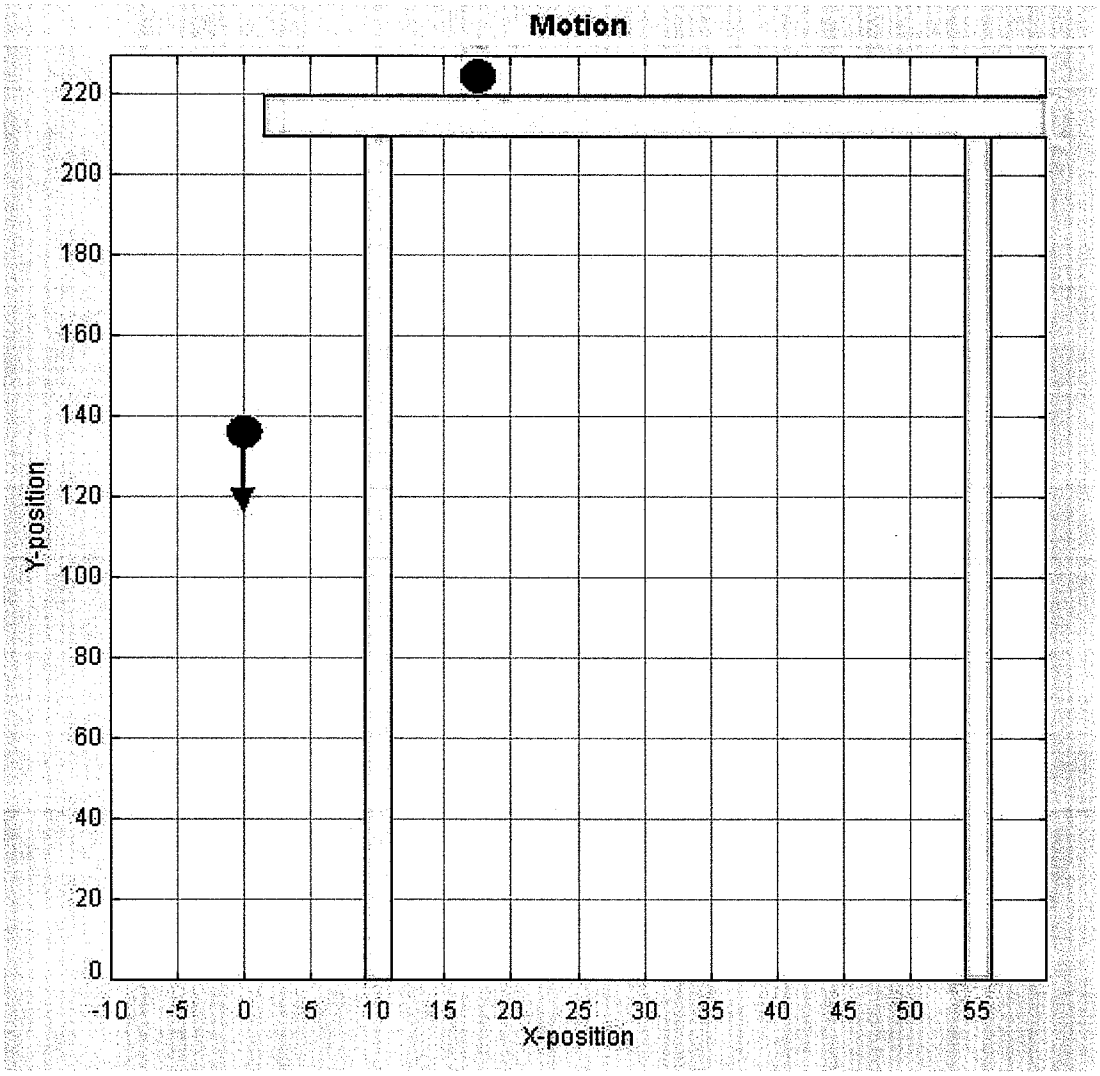


The second simulation, **Using Vectors to Study Motion**, has many features. It also has three graphs to correlate motion but the balls do not strobe. In addition to play/pause, step, and reset, there are force vector and velocity vector buttons. Also a slider can change the horizontal velocity of the red ball.

This simulation illustrates by means of velocity vectors that the velocity of the red ball is constant and the velocity of the blue ball is increasing.



Also in this simulation the net force on the object can be shown. There is no net force on the red ball and therefore it is behaving according to Newton's First Law of Motion. The blue ball has a net force equal to the force of gravity on it and therefore is obeying Newton's Second Law of Motion.



The final simulation, **Airplane Drop**, puts the two components of projectile motion together by means of cargo being dropped by an airplane. The initial horizontal velocity can be changed.