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Numerically Approximating the Flight of Baseballs and Footballs. Preliminary report.

The problem that we shall examine in this talk is that of the trajectory of objects such as baseballs and footballs. We shall analyze their flight trajectory, maximum height, and distance traveled. We shall estimate the mass and cross-sectional area of the object, consider the initial velocity and acceleration of the object, the spin of the object, the coefficient of drag, and the effects of the wind. The solution of the corresponding differential equations will be approximated and rendered in a 3D graphics package allowing students to see the flight path in R3 from any position and angle in R3. The objects will be mathematically modeled in the graphics package Studio 3D Max. The model consists of a triangular mesh made up of vertices. Using these vertices and a density function, the surface area, volume, mass, and cross-sectional area of the object will be approximated. Using these cross-sectional area and mass approximations, as well as the above mentioned factors, approximations of the flight equations are derived using Runge-Kutta methods. The effects of wind and the coefficient of drag on the distance traveled and the maximum height of the object are studied via simulations. (Received September 24, 2012)