Blog Entry © Thursday, May 22, 2025, Baseball Ballistics with Simple Drag Computation by James Pate Williams, Jr.

Back in August 2017 I ran across the following webpage:

http://www.lajpe.org/sep13/04-LAJPE-782_Chudinov.pdf

The paper analytically solves a projectile's motion using a formula for the velocity of the particle mass that varies with the square of the particle's velocity. I implemented the previous author's algorithm in C#. The test particle used was a spherical baseball.

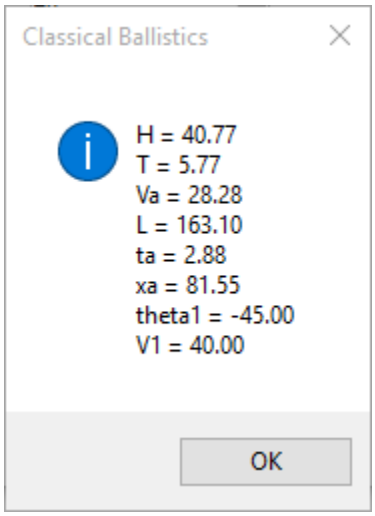

Figure 1Classical Baseball Ballistics

Legend: Initial velocity is 40 meters per second, initial angle is 45 degrees, H is the height at the apex (apogee or summit) in meters, T is the time of flight in seconds, Va is the velocity at the apex in meters per second, L is the range in meters, ta is the time to reach the apogee, xa is the x-coordinate in meters, theta1 is the striking angle in degrees, and V1 is the striking velocity in meters per second.

For comparison with the analytic projectile motion using drag, we implemented a Runge-Kutta fifth order numerical solution. The results are as follows:

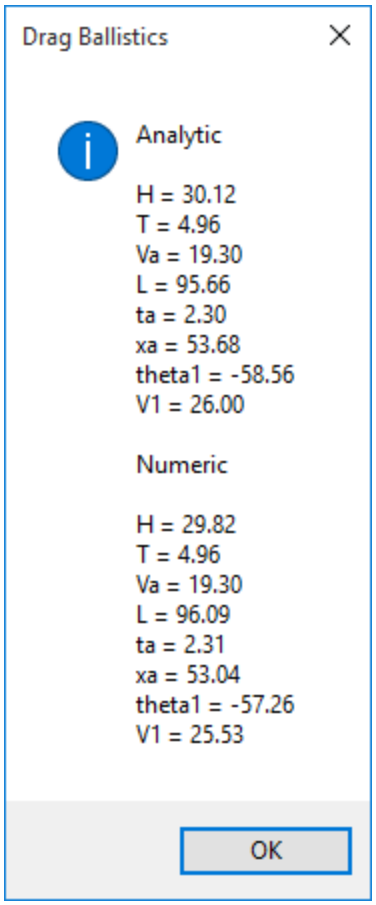

Figure 2 Drag Ballistics

The agreement between the two methods (analytic and numeric) is quite good. I translated the C# application to a Windows 32 C/C++ console solution. The results of the translation are as below:

```
V0 (m / s) or 0 to quit: 40
Enter angle in degrees: 45
Classical Ballistics
H      = 40.77
T      = 5.77
Va     = 28.28
L      = 163.10
Ta     = 2.88
xa     = 81.55
theta1 = -45.00
V1     = 40.00
Drag Ballistics
H      = 30.12
T      = 4.96
Va     = 19.30
L      = 95.66
Ta     = 2.30
xa     = 53.68
theta1 = -58.56
V1     = 26.00
```