

VVnA R Package

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Introduction

The VVnA “Validation, Verification, and Accreditation” package is a package intended for

Functions

Projectile Motion

Projectile motion in vacuum and in air are calculated with the `projectile` and `projFrictionLin` functions respectively. when considering air friction effects on projectiles, we only consider the viscous drag which is related to the velocity v . The Inertial drag related to the square of the velocity is not treated in this package.

In each of these two cases, a function will return the following projectile parameters:

1. `x`: Displacement in the horizontal direction as a function of time (in meters)
2. `vx`: Speed in the horizontal direction as a function of time (in m/s units)
3. `y`: Displacement in the vertical direction as a function of time (in meters)
4. `vy`: Speed in the vertical direction as a function of time (in m/s units)
5. `y_x`: Displacement in the vertical direction as a function of horizontal displacement (in meters)

In all cases, it is assumed that there are no motion in the lateral direction.

Projectile Motion in Vacuum

Arguments of the `projectile` function are:

1. `v0`: Initial velocity in m/s
2. `y0`: Initial height in m

3. `theta0`: Initial angle in degrees

4. `t`: Time of flight in seconds

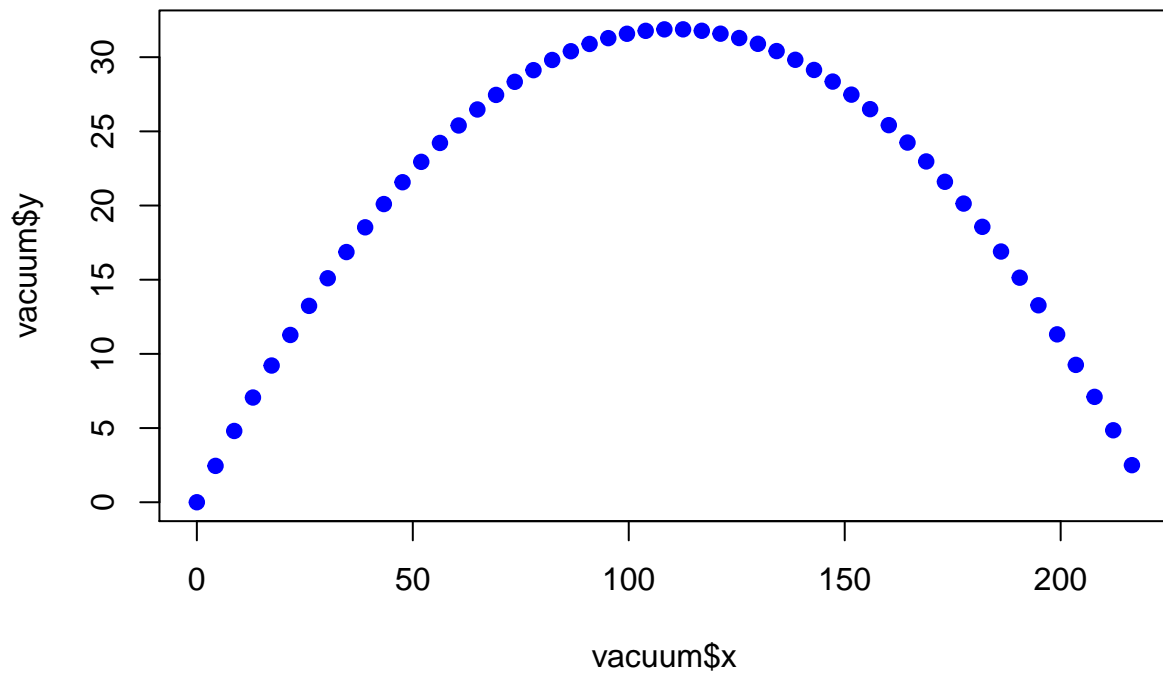
For vectors of length 1 for all arguments, the function will return a list of projectile parameters for those arguments. For example for an initial velocity `v` of 30 m/s, initial height `y` of 0 m, initial projectile angle `theta0` of 30 degrees, and at time `t=3 seconds` we get:

```
projectile(t = 3, y0 = 0, v0 = 30, theta0 = 30)
```

```
## $x
## [1] 77.94
##
## $vx
## [1] 25.98
##
## $y
## [1] 0.9
##
## $vy
## [1] -14.4
##
## $y_x
## [1] 0.9
```

One can also pass a vector of length > 1 for any individual input parameter. This is most useful for the time parameter `t`:

```
vacuum <- projectile(t = seq(0,5,0.1), y0 = 0, v0 = 50, theta0 = 30)
plot(vacuum$x, vacuum$y, pch=19, col="blue")
```



```
t <- seq(0,5,0.1)
vacuum <- projectile(t = t, y0 = 0, v0 = 50, theta0 = 30)
## prepare grid
par(mfcol=c(2,2), mar = c(3.5,3,1,1), oma=c(2,2,2,2), mgp=c(2.2,1,0))
plot(t, vacuum$x, pch=19, col="blue")
points(t, rep(vacuum$vx, length(t)), pch=19, col="blue")
points(t, vacuum$y, pch=19, col="blue")
```

