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Assembly Final Write Up of Physics

t_{barrel} = 100 ms or 0.1 s ... mcharge = 0.00

• Make individual pieces of the program

input: "TAR N RNG XXXX.XX BR YYY.YY SP SS.SS
DIR 222.22 NULL"
0 1 2 3
26 27 28 29 30 31

TAR N => 1-6, integer number
RNG XXXX.XX => Floating point in meters
BR YYY.YY => Bearing in degrees, floating point number
SP SS.SS => speed in m/s, floating point number
DIR 222.22 => direction in degrees, floating point number
NULL - "\0" : terminating character

output: "TAR N BR XXX.XX EV YY.YY CR6 QQQ.QQ NULL"

TAR N => parse input at 3
BR XXX.XX => corrected bearing: see below
BR String = XXX.XX
original

K_Charge = 200000000.0
L_barrel = 10.0
m_projectile = 100.0
t_barrel = 0.1

a_projectile = (2.0 * L_{barrel}) / (t_{barrel} * t_barrel)
v_projectile = a_projectile * t_{barrel}
Phi = toFloat(DIR 222.22) * 3.14159 / 180.0
V_proj_xy = V_projectile * cos(Phi)
V_Proj_z = v_projectile * sin(Phi)
t_flight_uncor = (2.0 * v_proj_z) / 9.8
R_proj_uncor = v_proj_xy * t_flight_uncor
:

Assembly Final contd.

Collected Bearing: theta = tofloat($BR_{original}$ YYY.YY) * 3.14159 / 180.0

R_x = R_proj_uncor * cos(theta)

R_y = R_proj_uncor * sin(theta)

D = tofloat($SP_{original}$ SS.SS) + t_flight_uncor

D_x = D * cos(Phi)

D_y = D * sin(Phi)

Bearing_aim = arctan((R_x + D_x) / (R_y + D_y))

Bearing_aim = (Bearing_aim * 180.0) / 3.14159

EV YY.YY => barrel elevation x axis

R_aim = Sqrt(((R_x + D_x) * (R_x + D_x))
+ ((R_y + D_y) * (R_y + D_y)))

t_flight_cor = D / v_projectile + t_flight_uncor

elev_aimed = arccos (R_aim / (v_proj_xy * t_flight_cor))

elev_aimed = (elev_aimed * 180.0) / 3.14159

CRG QQQ.QQ => Charge needed

M_charge = 2.0 * L_barrel * m_projectile /
(k_charge * (t_flight_cor * t_flight_cor))

NULL => Null termination

We know how to process inputs to produce outputs.

Lets perform an example with real numbers.

Output format:

TARN BR YXX.XX EV YY.YY CRG QQQ.QQ NULL

Assembly Final contd.

Practical Example * Assumes degrees

TAR N RNG XXXXX.XX BR YYY.YY SP SS.SS DIR ZZZ.ZZZ NULL

⇒ TAR 1 RNG 12345.67 BR 321.12 SP 11.11 DIR 001.10 NULL

$a\_projectile = (2.0 * L_{barrel}) / (t_{barrel} * t_{barrel}) = 2000$

$v\_projectile = a\_projectile * t_{barrel} = 2000 * 0.1 = 200$

$Phi = (001.10 * 3.14159) / 180.0 = 0.0191986$

$v\_proj\_xy = v\_projectile * \cos(Phi) = 199.99$

$v\_proj\_z = v\_projectile * \sin(Phi) = 3.8349$

$t\_flight\_uncor = (2 * v\_proj\_z) / 9.8 = (2 * 3.8...) / 9.8 = 0.783568$

$R\_proj\_uncor = v\_proj\_xy * t\_flight\_uncor = 199.99 * .783$

$= 156.685$

$theta = (321.12 * 3.14159) / 180 = 5.60459656$

$R\_x = R\_proj\_uncor * \cos(theta) = 156.685 * \cos(5.60) = 121.923$

$R\_y = R\_proj\_uncor * \sin(theta) = 156.685 * \sin(5.60) = -98.3503$

$D = 11.11 * t\_flight\_uncor = 11.11 * 0.783... = 8.70544$

$D\_x = D * \cos(Phi) = 1.519848 * \cos(0.019) = 8.70384$

$D\_y = D * \sin(Phi) = 1.519848 * \sin(0.019) = 0.167122$

$Bearing\_aim = \arctan((121.923 + 8.70...) / (-98.35 + 0.167122))$

$= -.92$

$Bearing\ aim = (-.92 * 180.0) / 3.14159 = -53.0809$

$R\_aim = \sqrt{((121.923 + 8.70)^2 + (98.35 + 0.167122)^2)}$

$= 163.451$

$t\_flight\_cor = 8.70 / 200 + .78 = .8235$

$elev\_aimed = \arccos(163.451 / (199.99 + .8235))$

$= .153214$

$elev\_aimed = 8.77$

$M\_charge = 2.0 * 10.0 * 100.0 / (2 \times 10^6 * (.8235 * .8235))$

$= 1.47 \times 10^{-5}$