

Start

Initialize
M = [5 X 1]
P = [5 X 5]
Q = [5 X 5]
S = [2 X 2]
R = [2 X 2]
Param = [7,1]

Predict

Wait for new measurement

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R1 = sqrt(M(1,1)^2 + M(2,1)^2)
V1 = sqrt(M(3,1)^2 + M(4,1)^2)
b = Param(2,1) * exp(M(5,:))
D = b .* exp((Param(5,1)-R)/Param(3,1)) * V1
G = -Param(4,1)/ R1^3;

dR_dx1 =M(1,1) / R1;
dR_dx2 = M(2,1) / R1;
dV_dx3 = M(3,1) / V1;
dV_dx4 = M(4,1) / V1;
db_dx5 = b;
dD_dx1 = b * (-dR_dx1/Param(3,1)) * exp((R0-R1)/Param(3,1)) * V1;
dD_dx2 = b * (-dR_dx2/Param(3,1)) * exp((R0-R1)/Param(3,1)) * V1;
dD_dx3 = b * exp((R0-R1)/Param(3,1)) * dV_dx3;
dD_dx4 = b * exp((R0-R1)/Param(3,1)) * dV_dx4;
dD_dx5 = db_dx5 * exp((Param(5,1)-R)/Param(3,1)) * V1;
dG_dx1 = -Param(4,1) * (-3 * dR_dx1 / R1^4);
dG_dx2 = -Param(4,1) * (-3 * dR_dx2 / R1^4);

df = zeros(5,5);
df(1,3) = 1;
df(2,4) = 1;
df(3,1) = dD_dx1 * M(3,1) + dG_dx1 * M(1,1) + G;
df(3,2) = dD_dx2 * M(3,1) + dG_dx2 * M(1,1);
df(3,3) = dD_dx3 * M(3,1) + D;
df(3,4) = dD_dx4 * M(3,1);
df(3,5) = dD_dx5 * M(3,1);

df(4,1) = dD_dx1 * M(4,1) + dG_dx1 * M(2,1);
df(4,2) = dD_dx2 * M(4,1) + dG_dx2 * M(2,1) + G;
df(4,3) = dD_dx3 * M(4,1);
df(4,4) = dD_dx4 * M(4,1) + D;
df(4,5) = dD_dx5 * M(4,1);

[5,5] A = eye(5,1) + Param(1,1) * df;

[5,1] dot_x = [M(3,1);M(4,1); D*M(3,1)+G*M(1,1); D *M(4,1) + G*M(2,1); 0];
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Task 1: $M = M + \text{Param}(1,1) \cdot \text{dot_x}$

Task 2: $P = A \times P \times A' + W \times Q \times W'$,
since W is identity matrix, $P = A \times P \times A' + Q$

Update

Task 3:

[2 X 1] MU =

[
sqrt [(M(1,1) - Param(6,1))^2 + (M(2,1) - Param(7,1))^2]
atan2 (M(2,1) - Param(7,1) , M(1,1) - Param(6,1))
]

Task 7: $M = M + K \times (Y - \text{MU})$, where Y is the
new measurement

Task4: [2 X 5] H =

[(M(1,1) - Param(6,1)) / F2) ((M(2,1) - Param(7,1)) / F2) 0 0 0 ;
((M(2,1) - Param(7,1)) / F1) ((M(1,1) - Param(6,1)) / F1) 0 0 0], where
F1 = [(M(1,1) - Param(6,1))^2 + (M(2,1) - Param(7,1))^2]

F2 = sqrt (F1)

Task 5: $S = V \times R \times V' + H \times P \times H'$, since V is identity matrix

[2 X 2] S = R + H X P X H'

Task 6: [4 X 2] K = P X H' X inv(S)

Task 8: $P = P - K \times S \times K'$