Part 1

In this section , a one dimensional data has been taken , a constant velocity model has been assumed.

State of the system are

System Equation

1d constant velocity

2d constant velocity

State transition matrix Φ

Where T is the sensor sample time interval.

Dynamic Noise covariance Q =

Where is the standard deviation of noise in dynamics of the system.

Measurement noise covariance R =

Where is the standard deviation of noise in measurement.

Measurement Equation

Therefore the observation matrix M =

System covariance matrix S is given by



Where is the standard deviation of position signal, is the standard deviation of velocity, is the covariance of position and velocity.

Based on the data provided, the rate at which the position is changing has been calculated ands stored as an array as

The initial values for States (X) and system covariance matrix (S) are based on first few values of the data. The number of values has been set as calibratable value.