Idriss Riouak

Assignment 4

Sensor fusion with GPS and IMU

Task 1: good to knows

The function gravity takes two parameters:

- **Lambda -> Latitude in degrees.**
- **h -> Altitued in meters.**

Geographic coordinates of Lund, Sweden

Latitude: 55°42′21″ N
Longitude: 13°11′35″ E
Elevation above sea level: 51 m = 167 ft

Geographic coordinates of Stockholm, Sweden

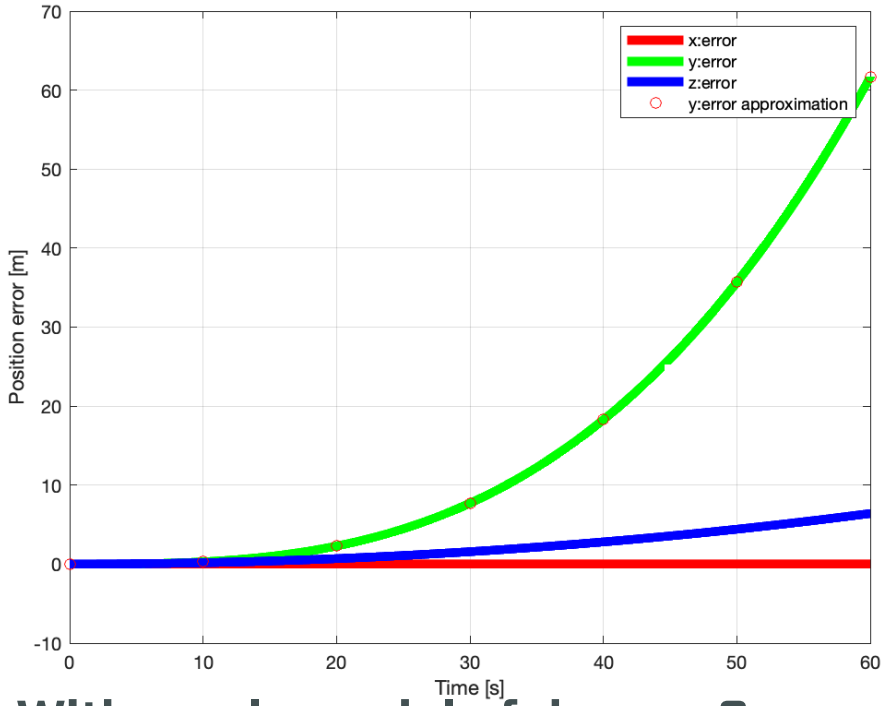
Latitude: 59°19′57″ N
Longitude: 18°03′53″ E
Elevation above sea level: 28 m = 91 ft

Polyfit funciton in Matlab:

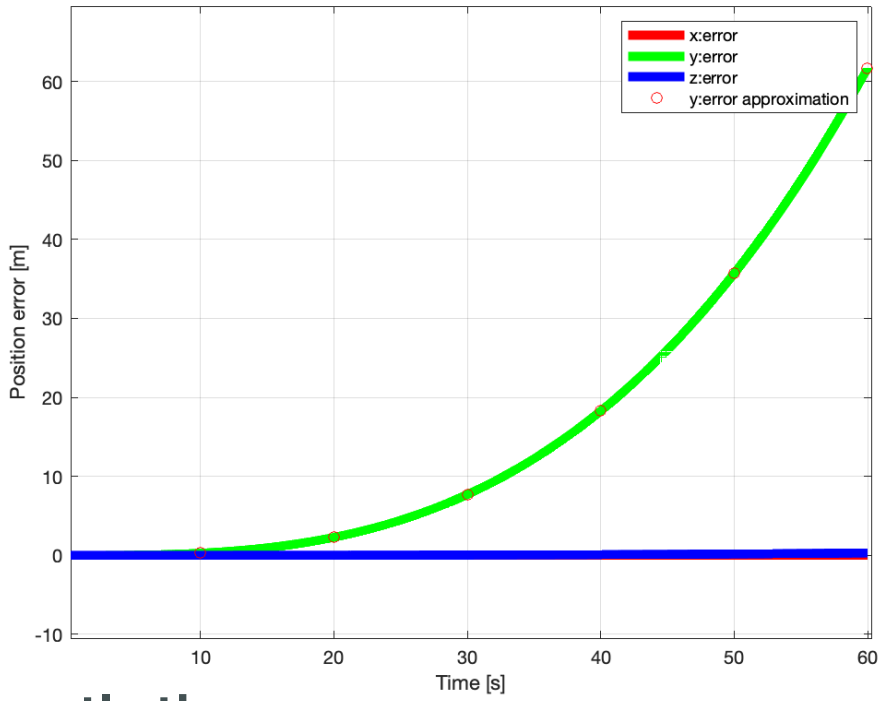
polyfit(x,y,n) -> Returns the coefficients for a polynomial p(x) of degree n that is a best fit for the data in y.

Task 1: Lund vs Stockholm

- Lund: Gravity(55,51)



- Stockholm: Gravity(59,28)



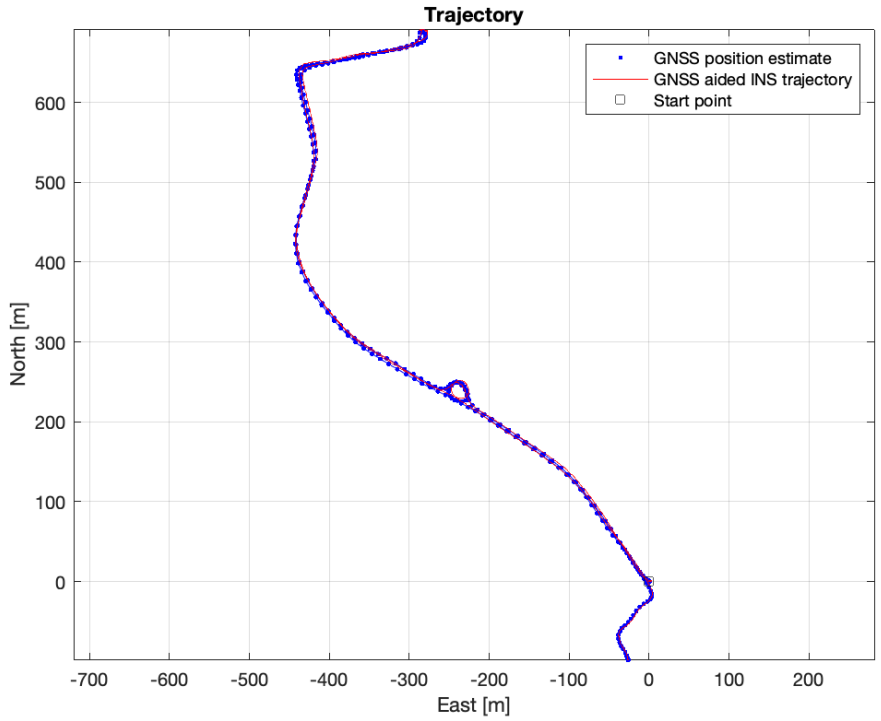
With a polynomial of degree 2 we cannot fit correctly the error curve.

Instead, with a polynomial of degree 3 we can fit the curve with high accuracy.

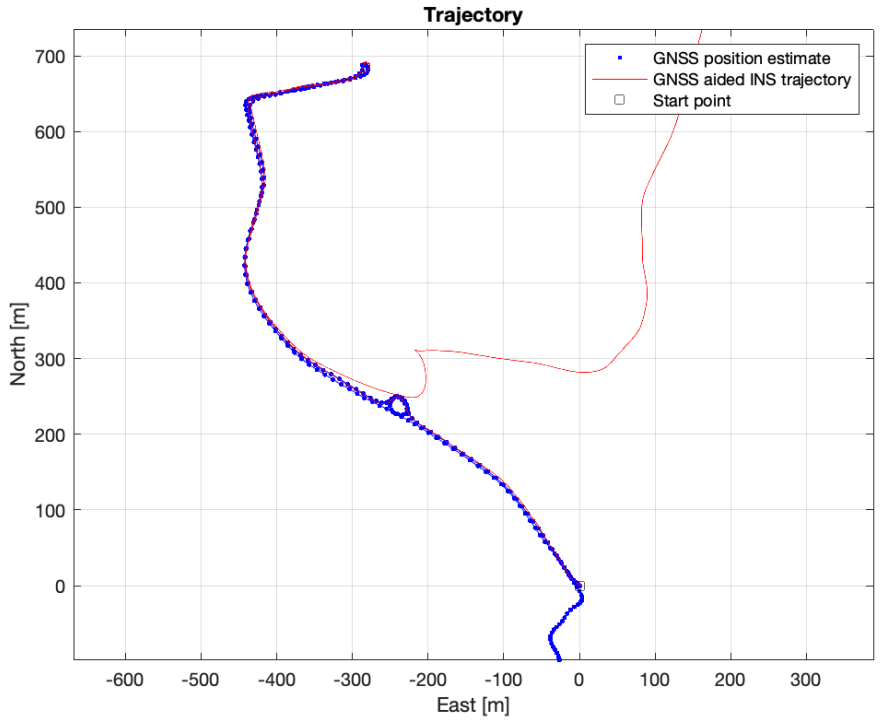
$P_{y\_error}(x) = 0.001 * (0.2855x^3 - 0.041x^2 - 0.033x + 0.0107)$

Task 2: Trajectory

- **Settings.gnss_outage = off**

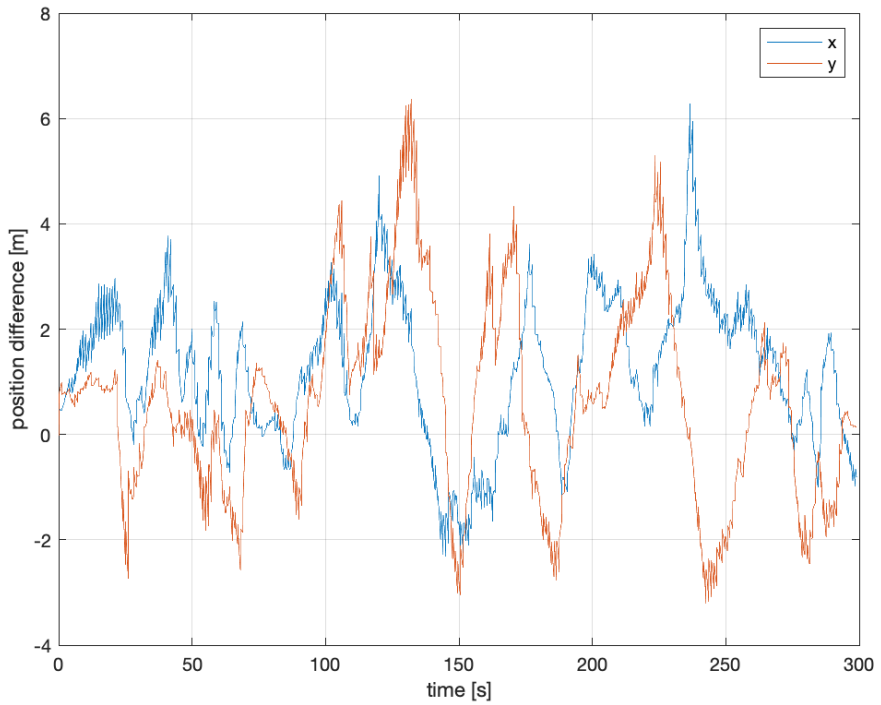


- **Settings.gnss_outage = on**

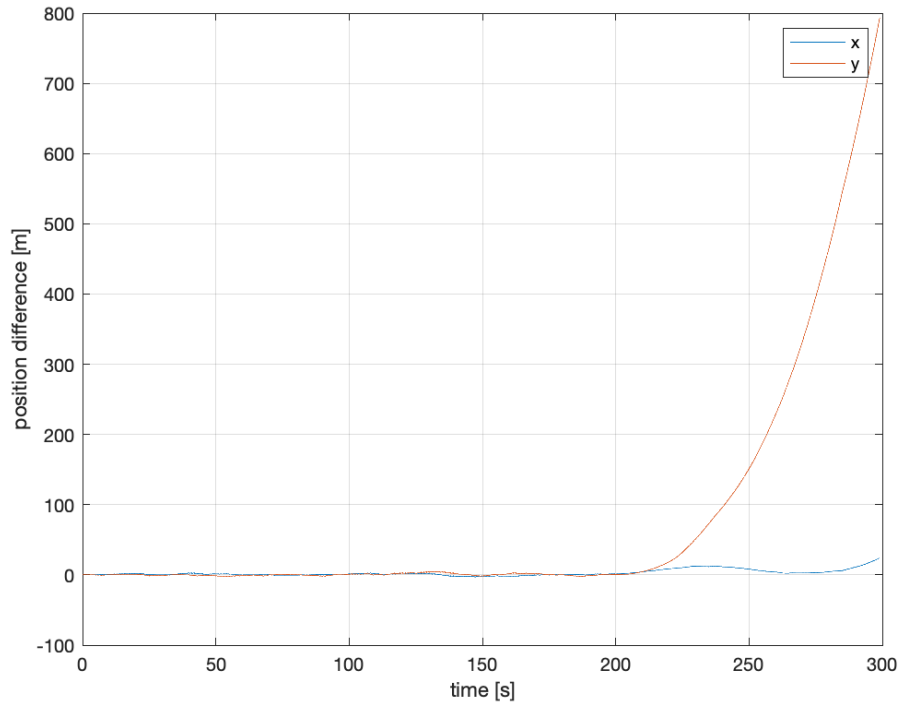


Task 2: position difference

- **Settings.gnss_outage = off**

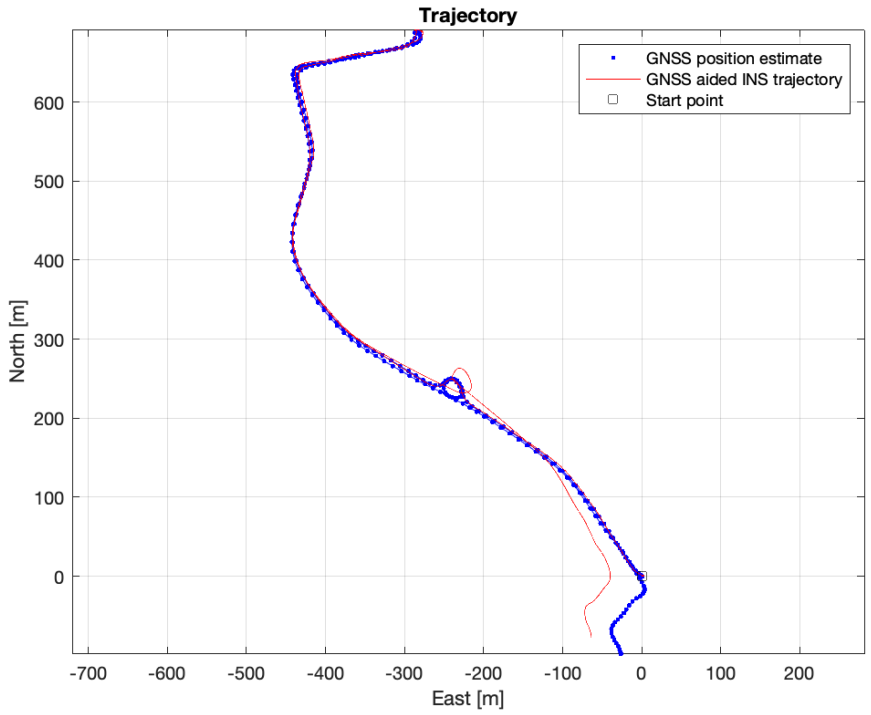


- **Settings.gnss_outage = on**



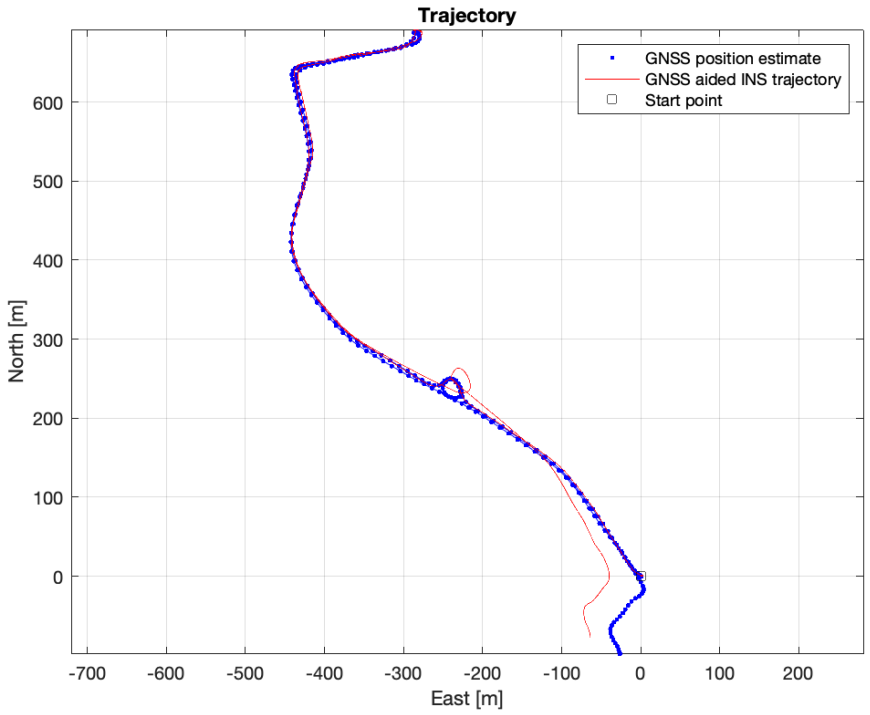
Task 3: non-holonomic support

- Settings.speed_aiding = off
- Settings.non_holonomic = on
- Settings.sigma_non_holonomic = 20 (default)



- positionerr_RMS = 20.6581

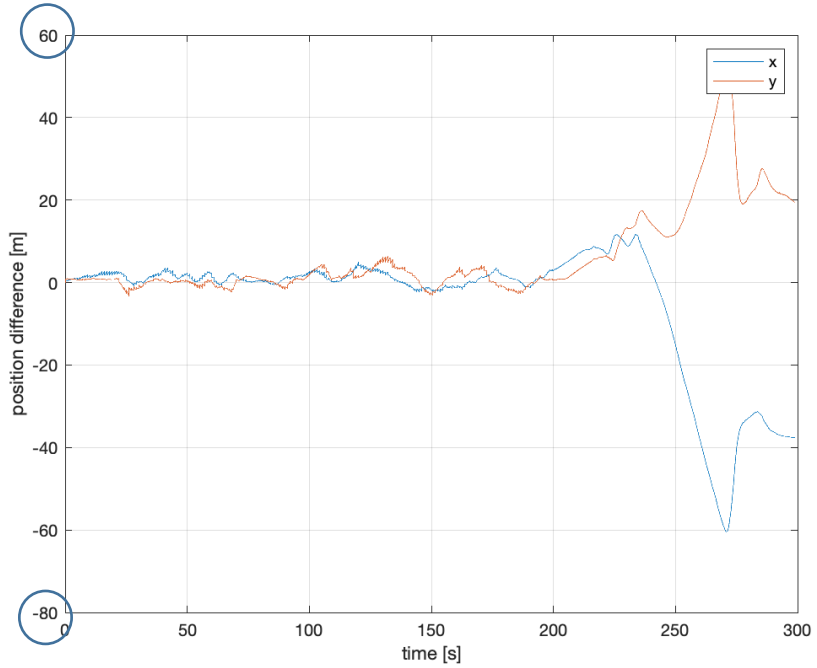
- Settings.speed_aiding = off
- Settings.non_holonomic = on
- Settings.sigma_non_holonomic = 13.320



- positionerr_RMS = 15.7915

Task 3: non-holonomic support

- Settings.speed_aiding = off
- Settings.non_holonomic = on
- Settings.sigma_non_holonomic = 20 (default)



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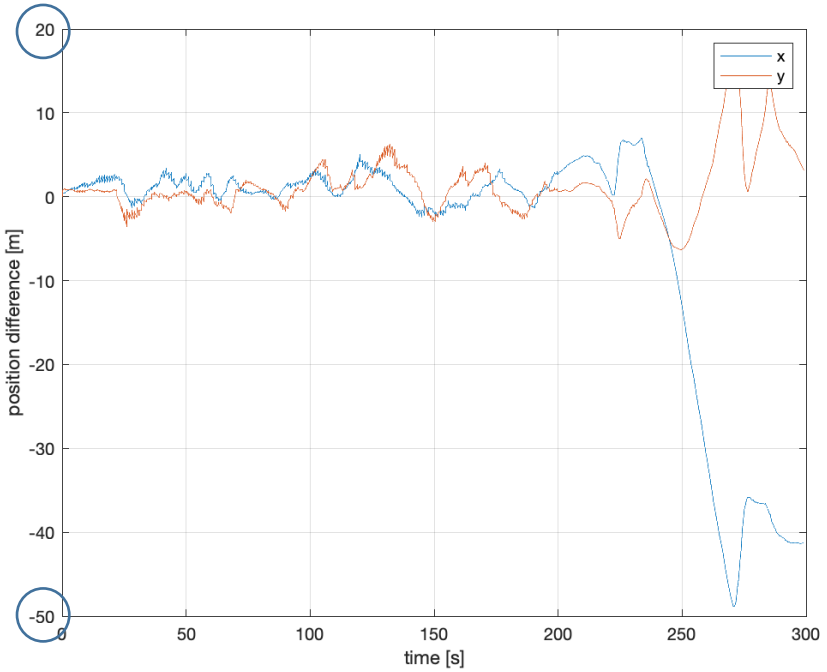
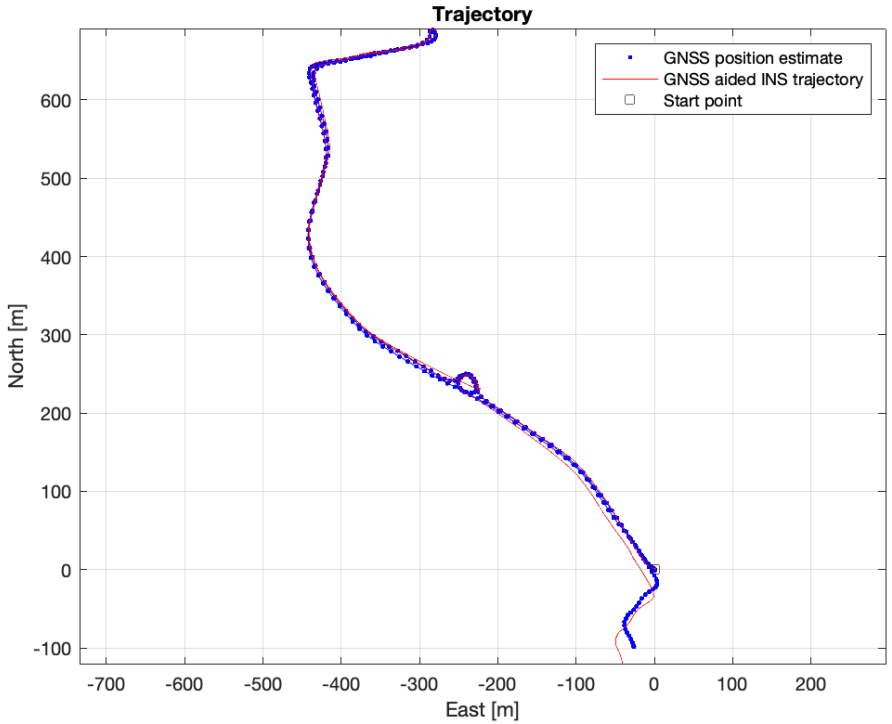


- positionerr_RMS = 15.7915

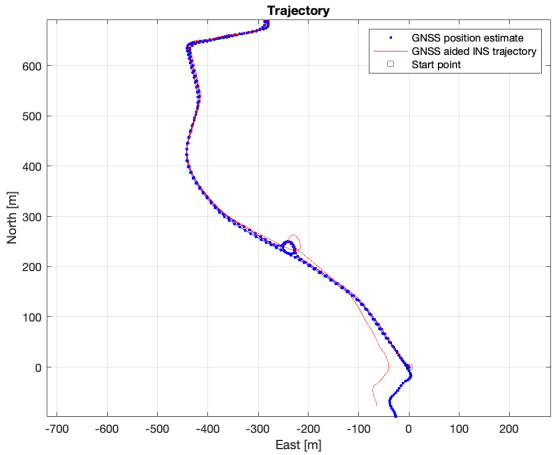
Task 4: Speedometer fusion

- Settings.speed_aiding=on
- Settings.speed_non_holonomic =on

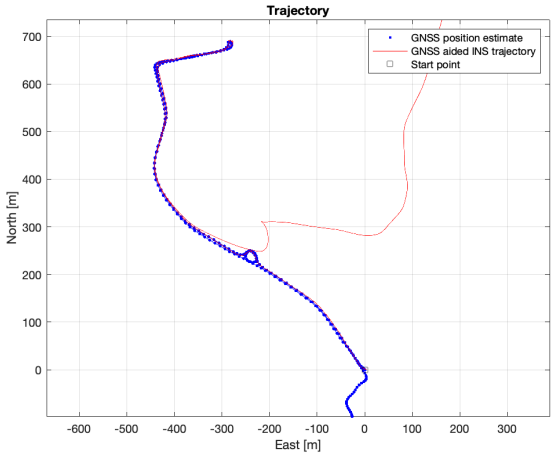


- positionerr_RMS = 8.1647

- Settings.speed_aiding = off
- Settings.non_holonomic = on (left) – off(right)
- Settings.sigma_non_holonomic = 13.320



- positionerr_RMS = 15.7915

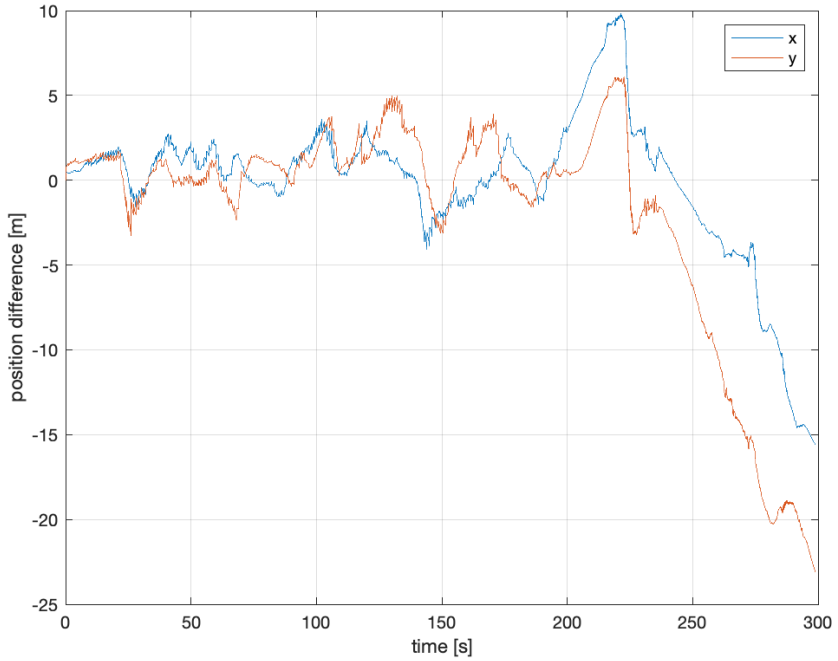


- positionerr_RMS = 201.0012

- Great improvement !

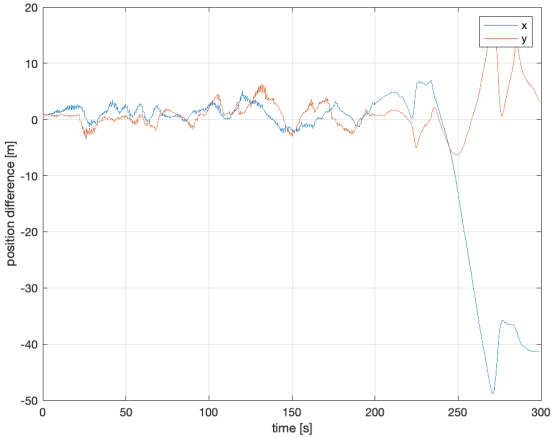
Task 4: Speedometer fusion

- Settings.speed_aiding=on
- Settings.speed_non_holonomic =on

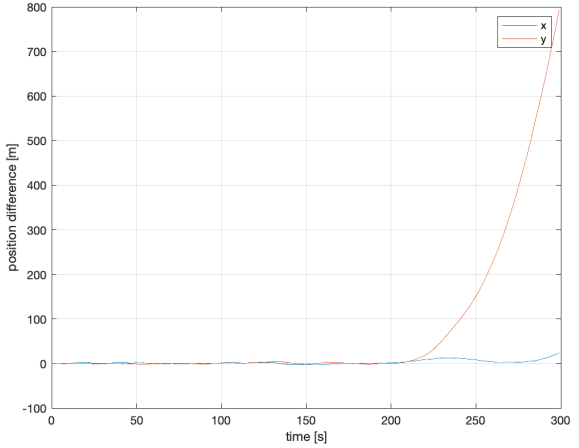


- positionerr_RMS = 8.1647

- Settings.speed_aiding = off
- Settings.non_holonomic = on (left) – off(right)
- Settings.sigma_non_holonomic = 13.320



- positionerr_RMS = 15.7915

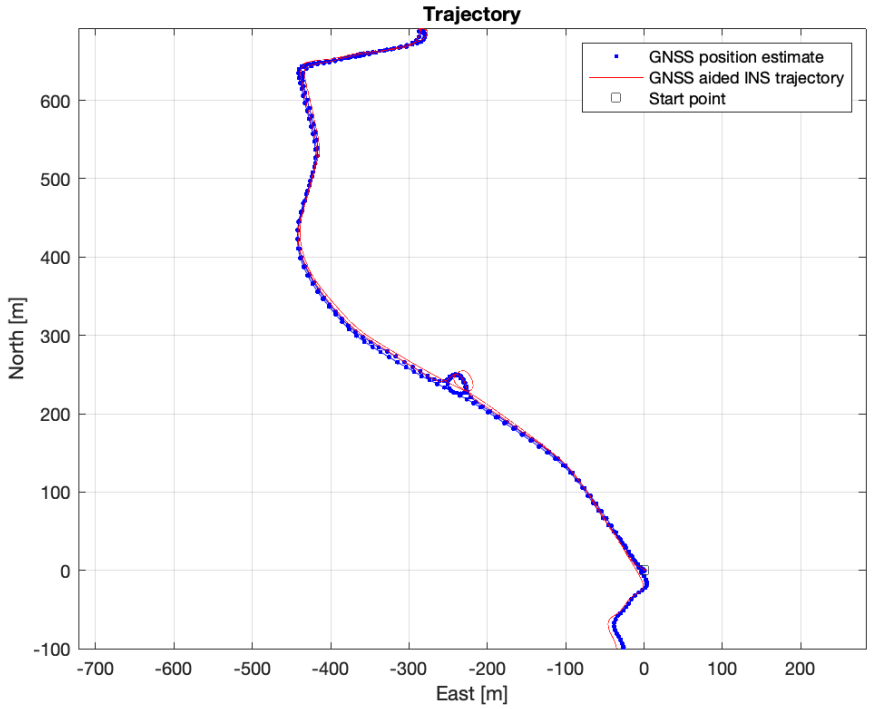


- positionerr_RMS = 201.0012

- Again ! Great improvement !

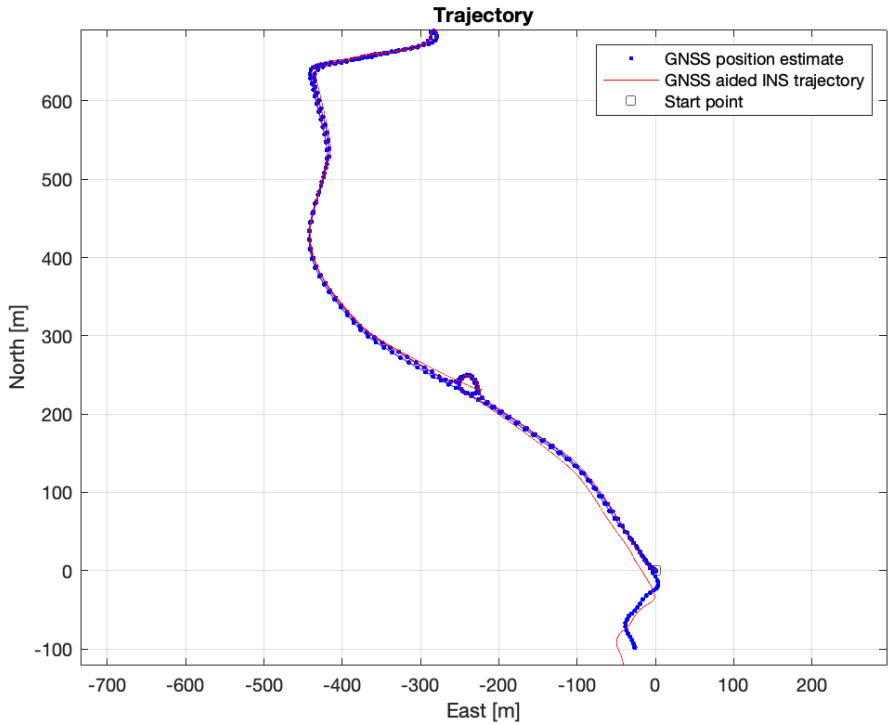
Task 4: sigma_speed

- Settings.speed_aiding=on
- Settings.speed_non_holonomic =on
- Settings.sigma_non_holonomic = 10.00
- Settings.sigma_speed=2.0100



- positionerr_RMS = 4.7667

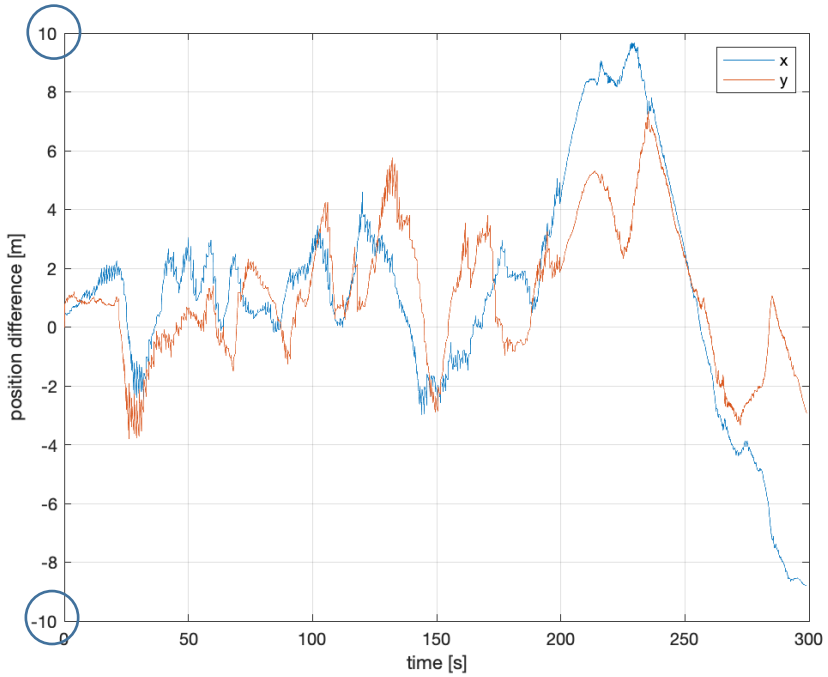
- Settings.speed_aiding=on
- Settings.speed_non_holonomic =on
- Settings.sigma_non_holonomic = 20.00 (default)
- Settings.sigma_speed=1 (default)



- positionerr_RMS = 8.1647

Task 4: sigma_speed

- Settings.speed_aiding=on
- Settings.speed_non_holonomic =on
- Settings.sigma_non_holonomic = 10.00
- Settings.sigma_speed=2.0100



- positionerr_RMS = 4.7667

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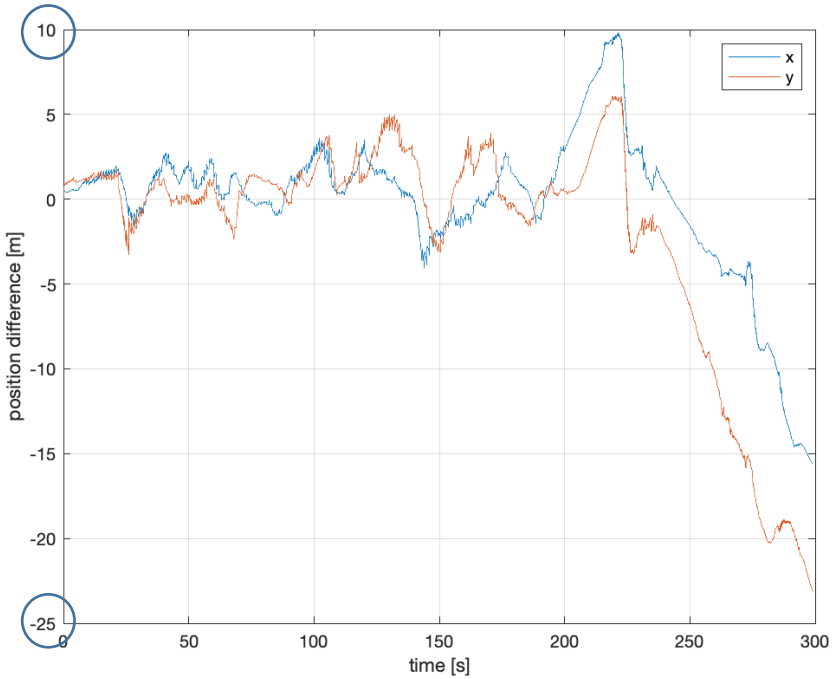
- Settings.sigma_non_holonomic = 20.00 (default)
- Settings.sigma_speed=1 (default)



- positionerr_RMS = 8.1647