

Figure 10: Mean errors vs. time after 100 runs – first 40 sec. for Trajectory 4 with 9 landmarks. The plot displays the mean error (m) on the y-axis (ranging from -60 to 60) against time (s) on the x-axis (ranging from 0 to 40). The legend identifies the following series:

- Error PF (Dark Blue line)
- Variance PF (Light Blue shaded area)
- Error UPF (Orange line)
- Variance UPF (Light Orange shaded area)
- Error PFC (Yellow line)
- Variance PFC (Light Yellow shaded area)
- Error UPFC (Purple line)
- Variance UPFC (Light Purple shaded area)
- Error PFS (Green line)
- Variance PFS (Light Green shaded area)
- Error UPFS (Cyan line)
- Variance UPFS (Light Cyan shaded area)

The plot shows that the PF method (Particle Filter) exhibits a significant positive bias, starting around 7m and decreasing slowly to about 1m. The UPF (Unscented Particle Filter) method shows a sharp initial drop to near zero. The PFC (Particle Filter with Covariance) and PFS (Particle Filter with Sigma-Point) methods also show rapid convergence to near-zero error. The UPFC and UPFS methods maintain near-zero error throughout. The variance for the PF method is notably larger than for the other methods, especially in the initial phase.

