Part 6: Tracking

Building a GPS receiver from scratch

Chris Doble

Goals

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- Track signal parameters over time

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  - Carrier wave frequency shift

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  - Carrier wave phase

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  - PRN code phase
- Decode fragments of navigation message bits
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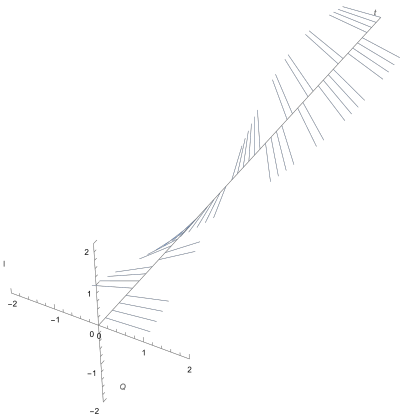
- Count PRN codes
  - Required to calculate the signal transmission time

Topics

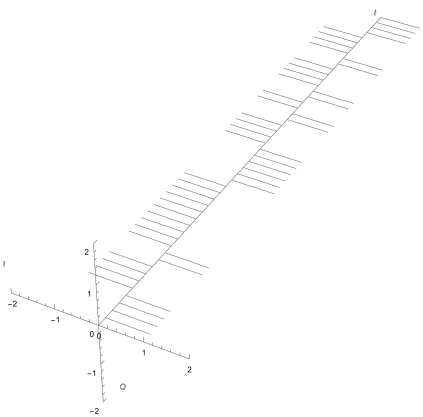
1. Carrier wipeoff
2. PRN code tracking
3. Correlation
4. Carrier wave tracking

Topics

Carrier wipeoff



$\Rightarrow$



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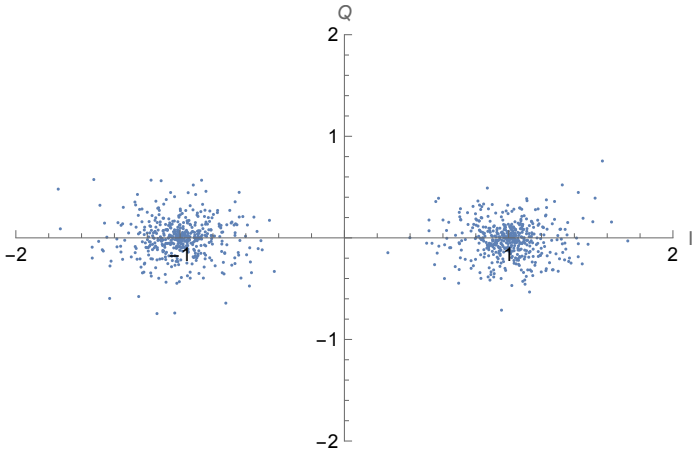

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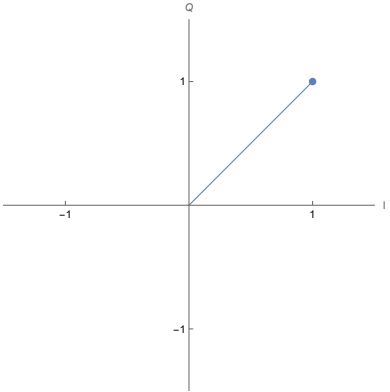
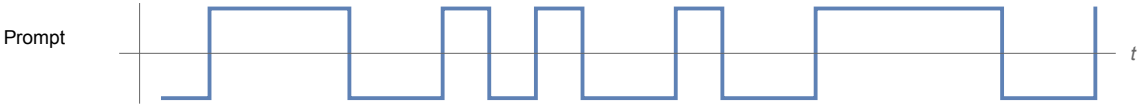
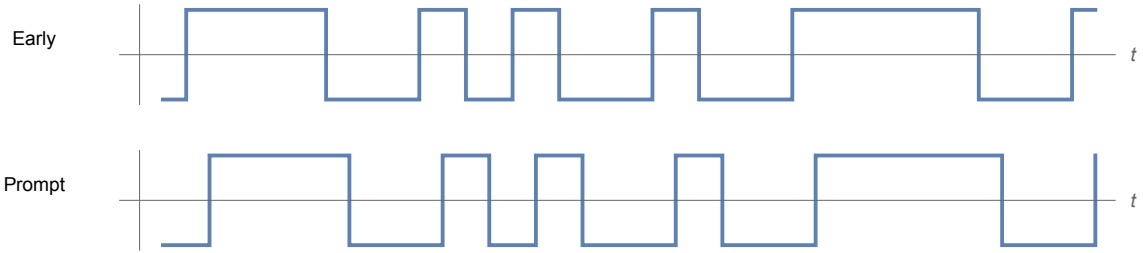


Topics

Delay-locked loop



Delay-locked loop



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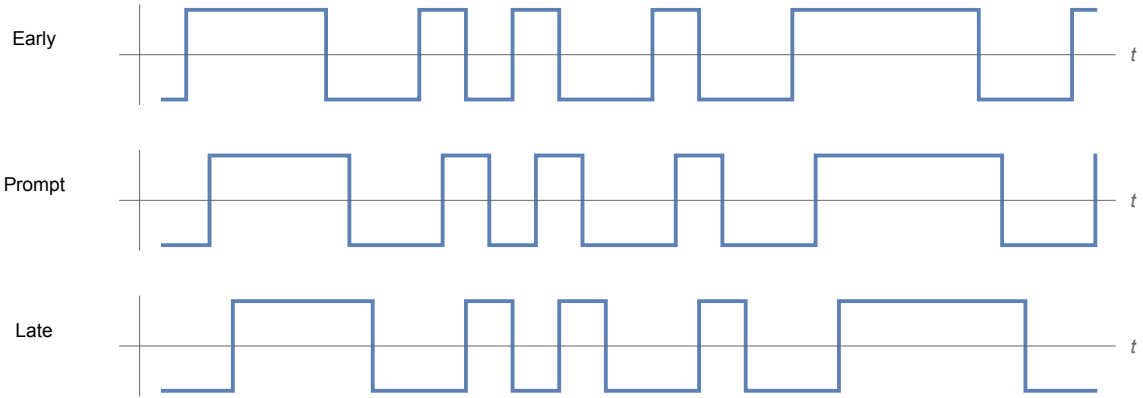
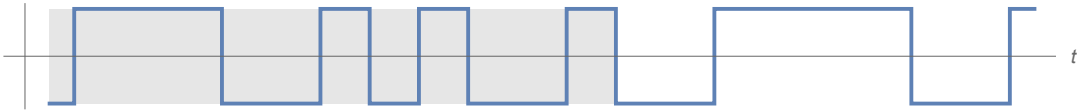


Accounting for frequency shift



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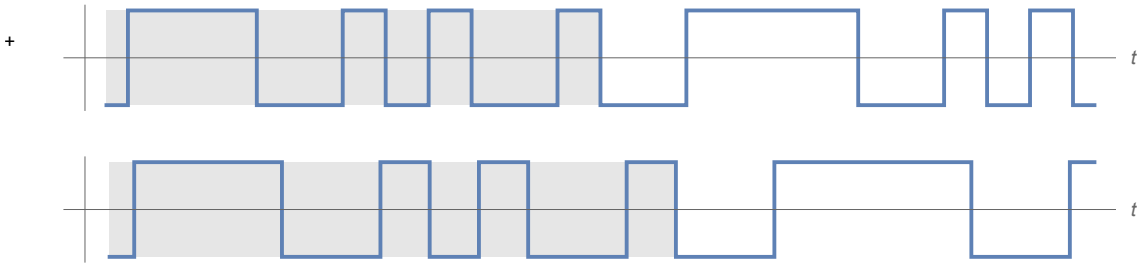

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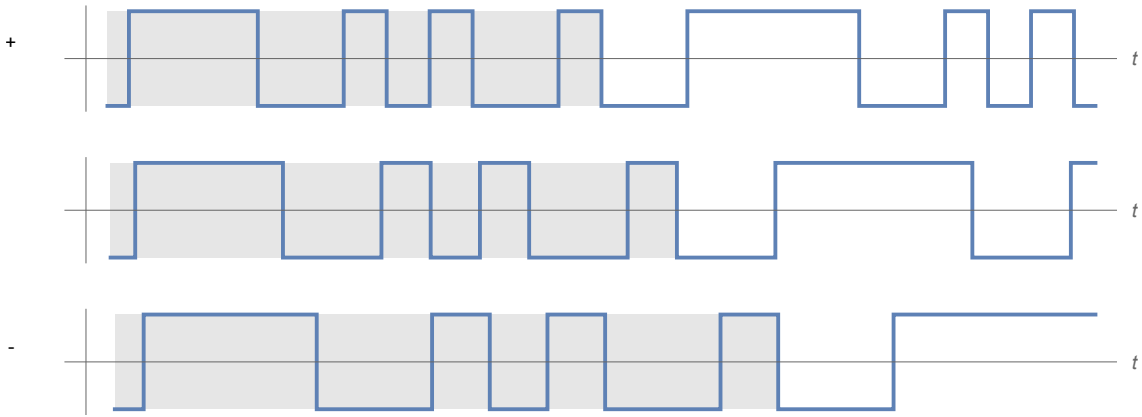

Accounting for frequency shift

$$\Delta\phi = \overbrace{2046}^{\text{PRN length}} \times \underbrace{\Delta f \div f_{L1}}_{\text{Percentage frequency change}}$$

Topics

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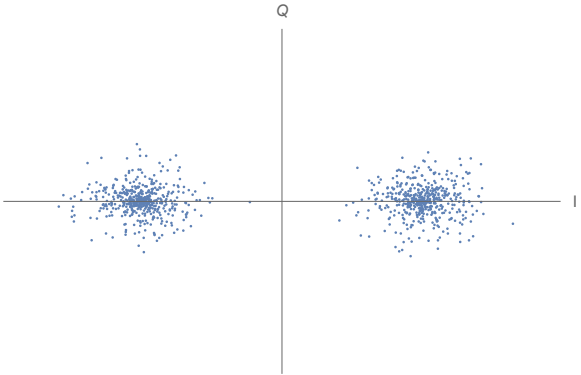

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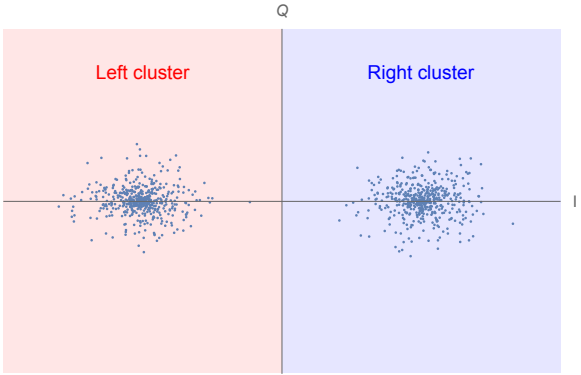

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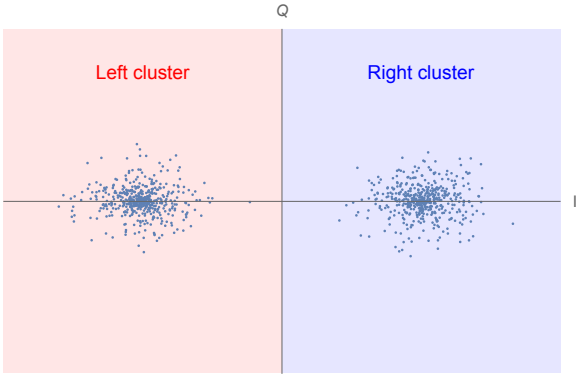

- These fragments are called “pseudosymbols”

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  - Use it to update them

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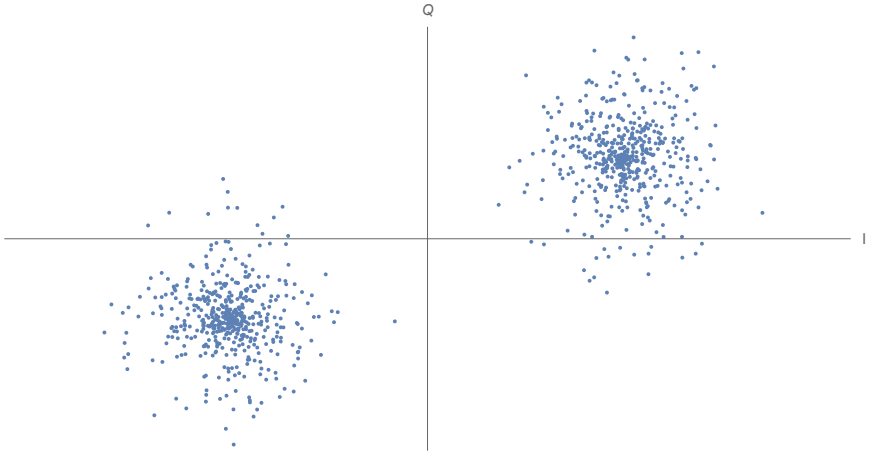

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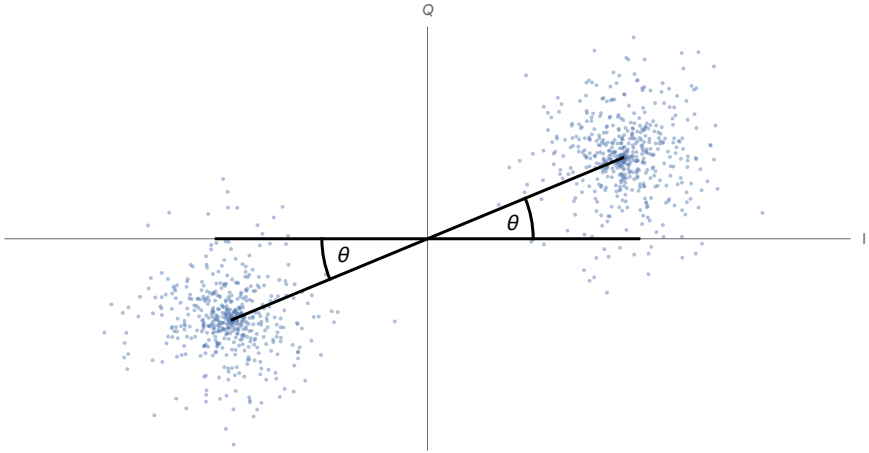

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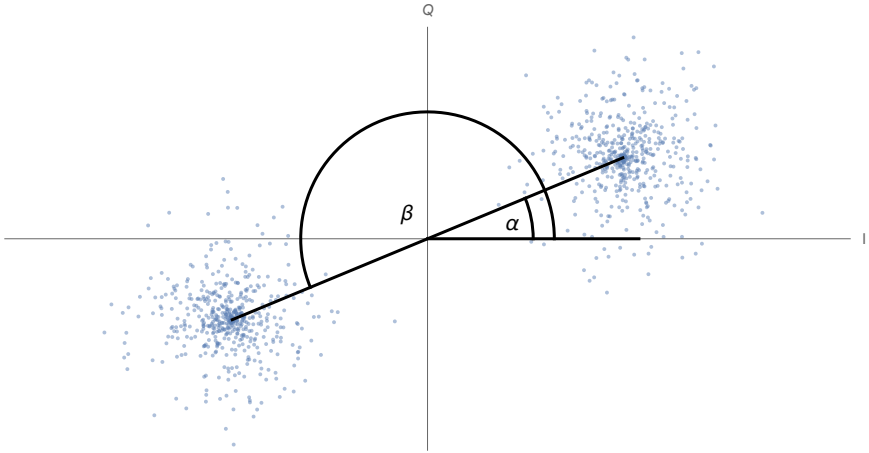

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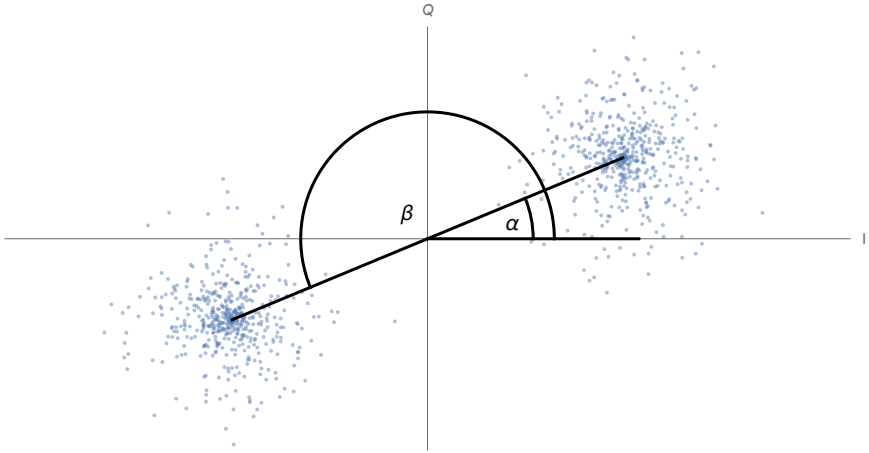

- Use `atan` rather than `atan2`

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- Phase gain should be around 25 $\times$ the frequency shift gain

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  3. Subtract the result from each estimate