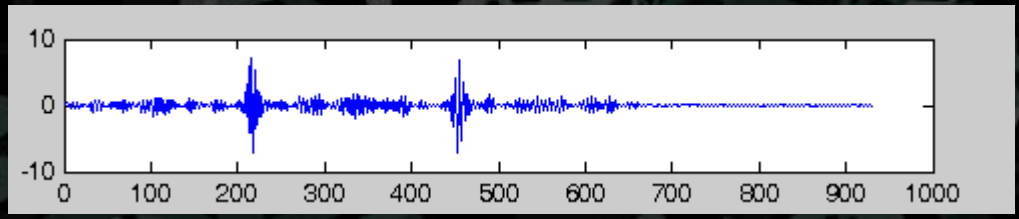
Modeling Interference



In passive wireless sensor networks

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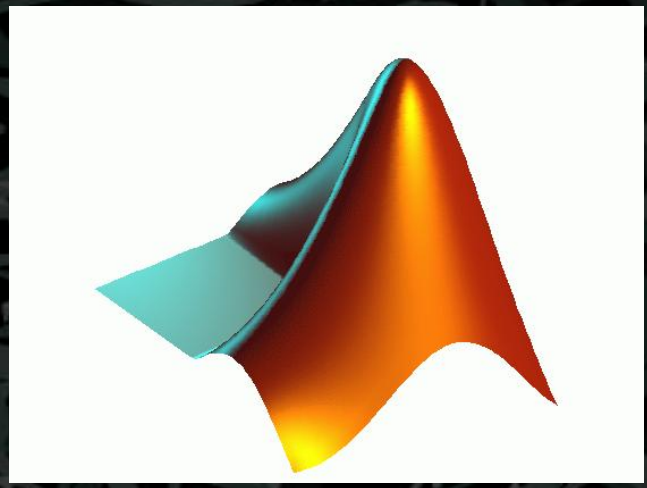
About this project

- Simulation only
- Matlab
- Model interference
- Passive wireless devices
- Objective: find when signal degradation prevents effective use of the system

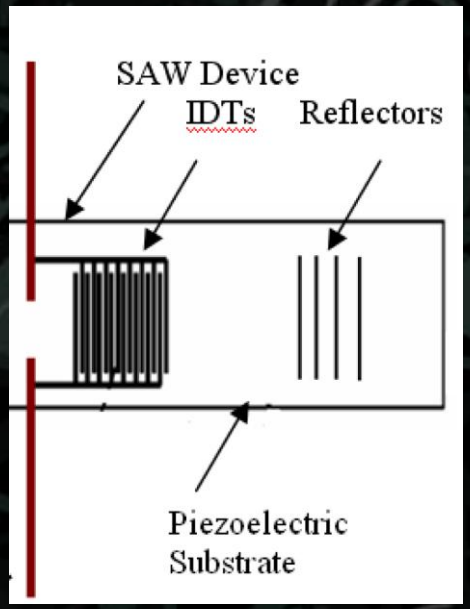
REU: Starting Out

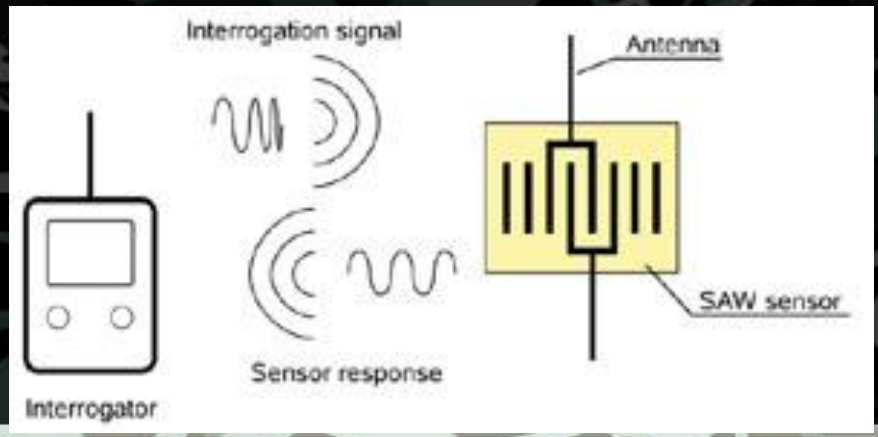
- Class
- Papers
- Learn MatLab
- Review code



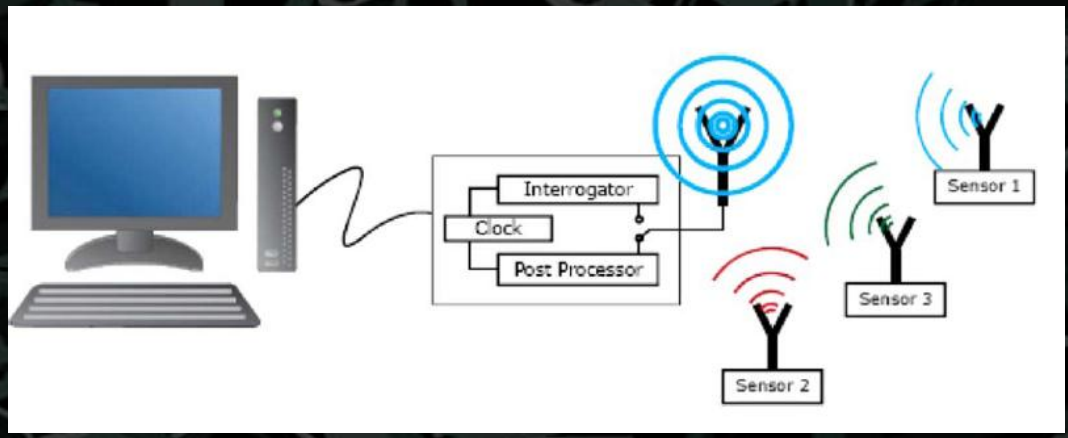
SAW Devices

- IDTs
- Reflectors
- Binary SAW Codes
- Identification

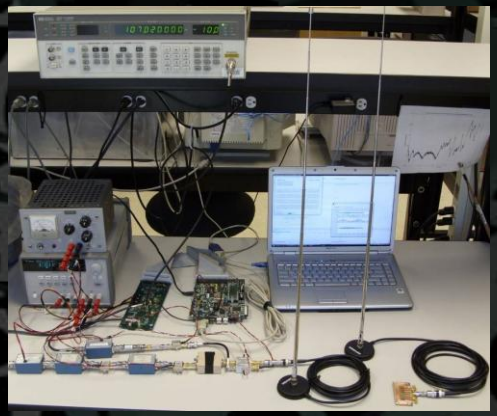




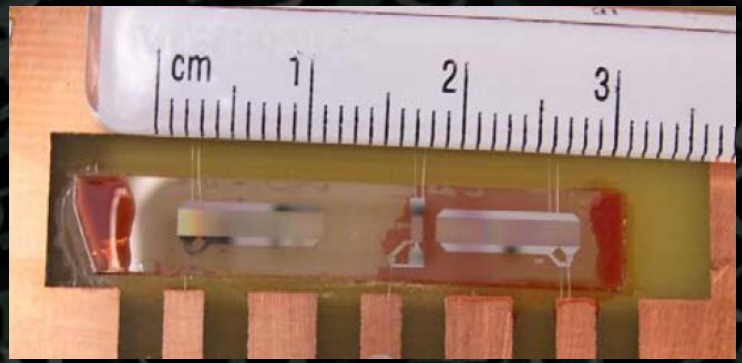
- All sensors are equidistant from “interrogator”



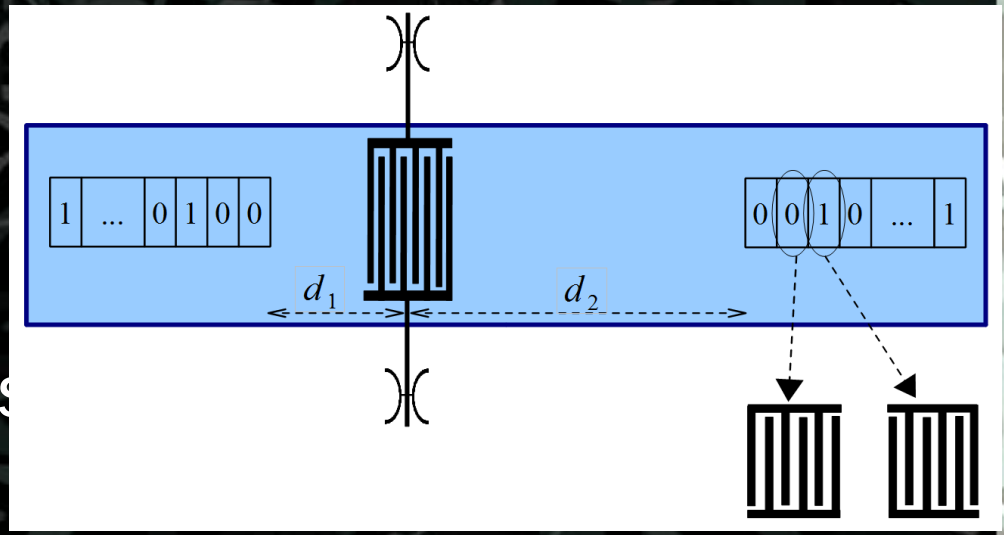
Interrogator Implementation



Sensor

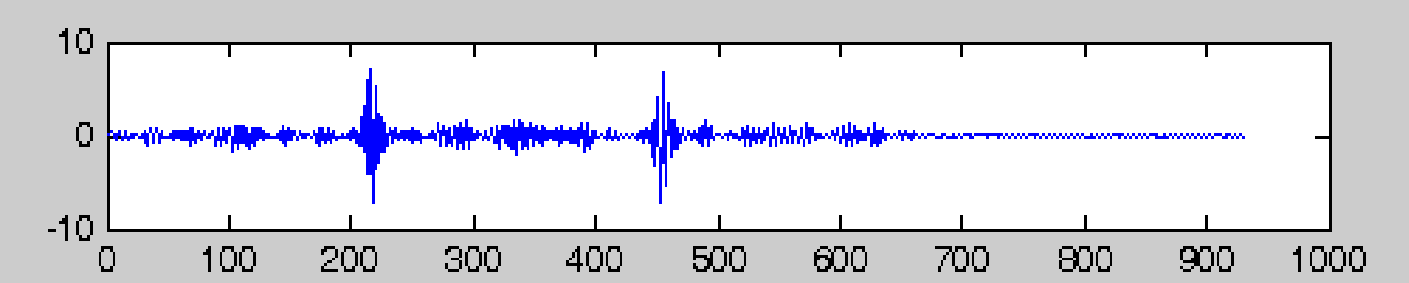


Code Sets

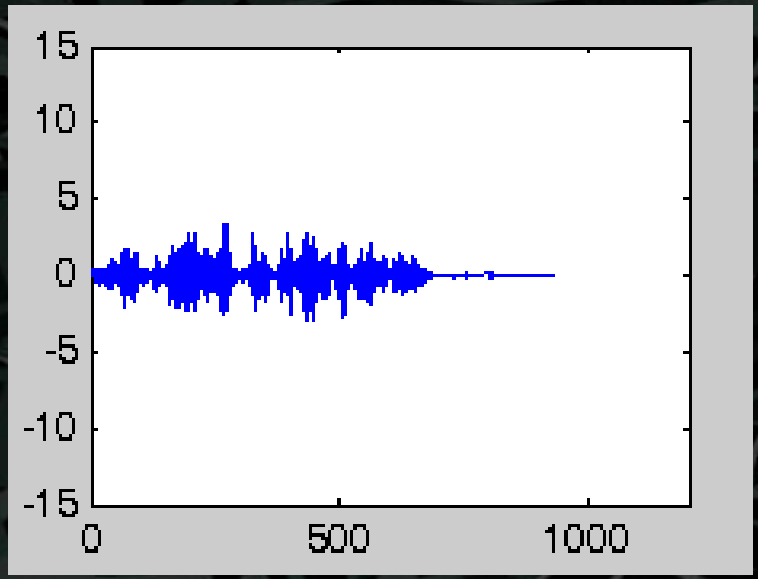


- Based on 31 codes
- 'Gold codes'
- Determined before I started working on my project
- Each one represents a “hard coded” sensor
- Interrogator sends out one code

- The magnitudes of the signals for each comparison are retrieved.
- If two codes match then two well defined peaks appear:



- If they don't match then there are no defined peaks:

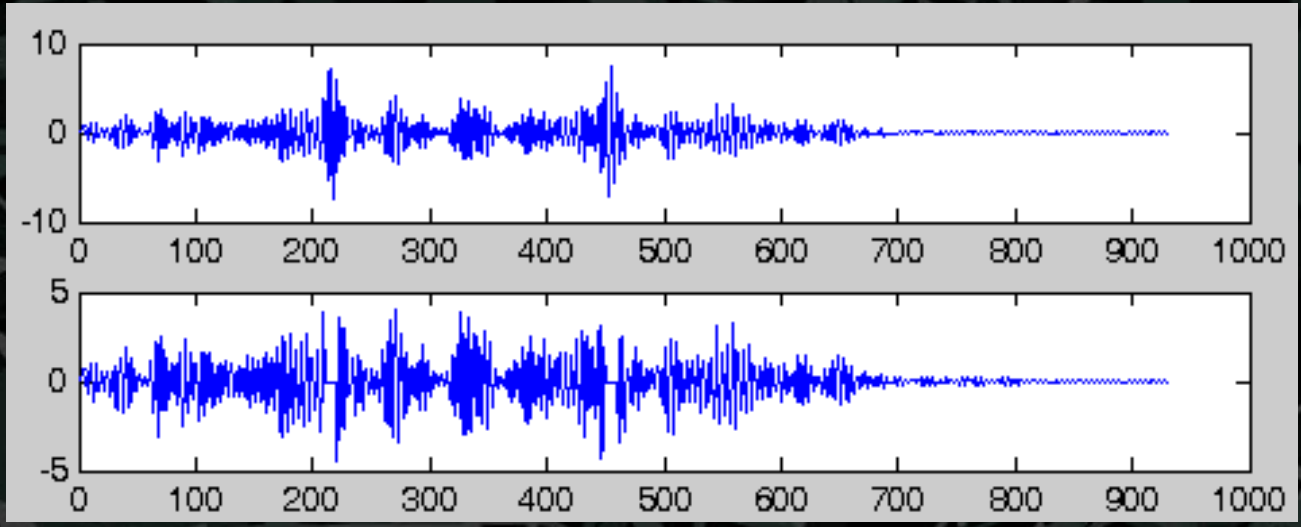


Interference

- In the field you get all the signals back, desired and undesired.
- The model take the first signal (which happens to be the desired signal) and adds all the following signals.
- The result is a new signal containing all the sensor feedback.

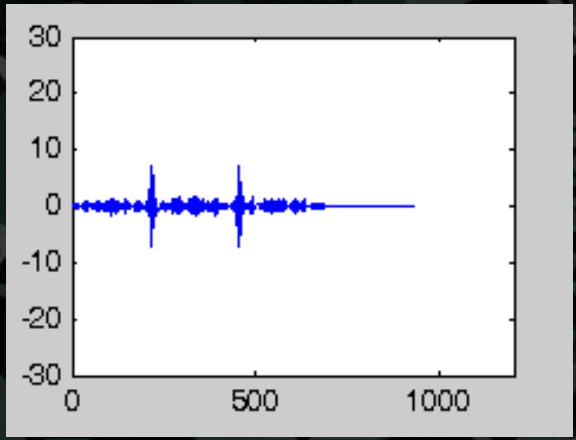
How to find distortion

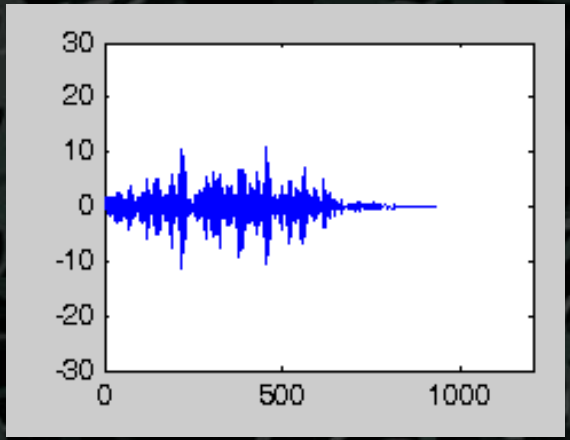
- Find two peaks from the initial match and remove them.



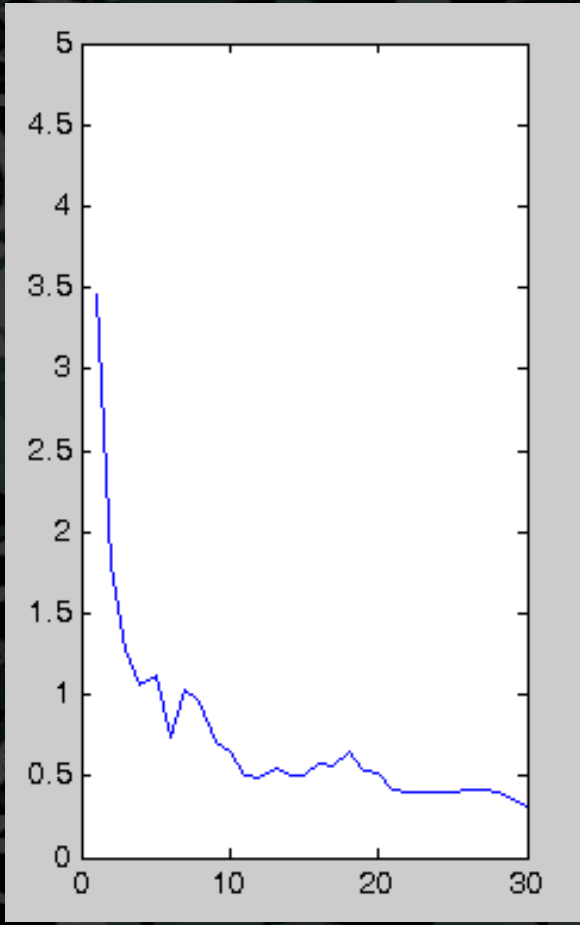
- Save their magnitude and location.

- Removing them allows you to analyze the surrounding peaks.
- After enough interference signals are added the highest peaks shift and distort.
- The initial matched peaks aren't relatively as high and become lost.





Peak to Side-lobe ratio



- h1/h2 where h1 is always the height of the initial peak
- h2 is the highest peak after the initial peak's removal.
- After ~6 sensors, the ratio goes below 1.

In Conclusion

- This system can support ~6 sensors.
- Different frequencies, more sensors
- More sensors could be supported if the interference is mitigated.
- Time delays can also allow more sensors
- Variability: By alternate signal filtering or different code sets altogether, more or fewer sensors may be accommodated.

What Else?

- Varying distance from the interrogator
  - More complex time delays
- Taking an unknown signal that had been altered by a measurand and includes interference and deciding which sensor it is.

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- Dr. Ali Abedi
- Abolfazl Razi
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Thank you!