Synthetic Aperture Radar(SAR) Imaging Simulation Software

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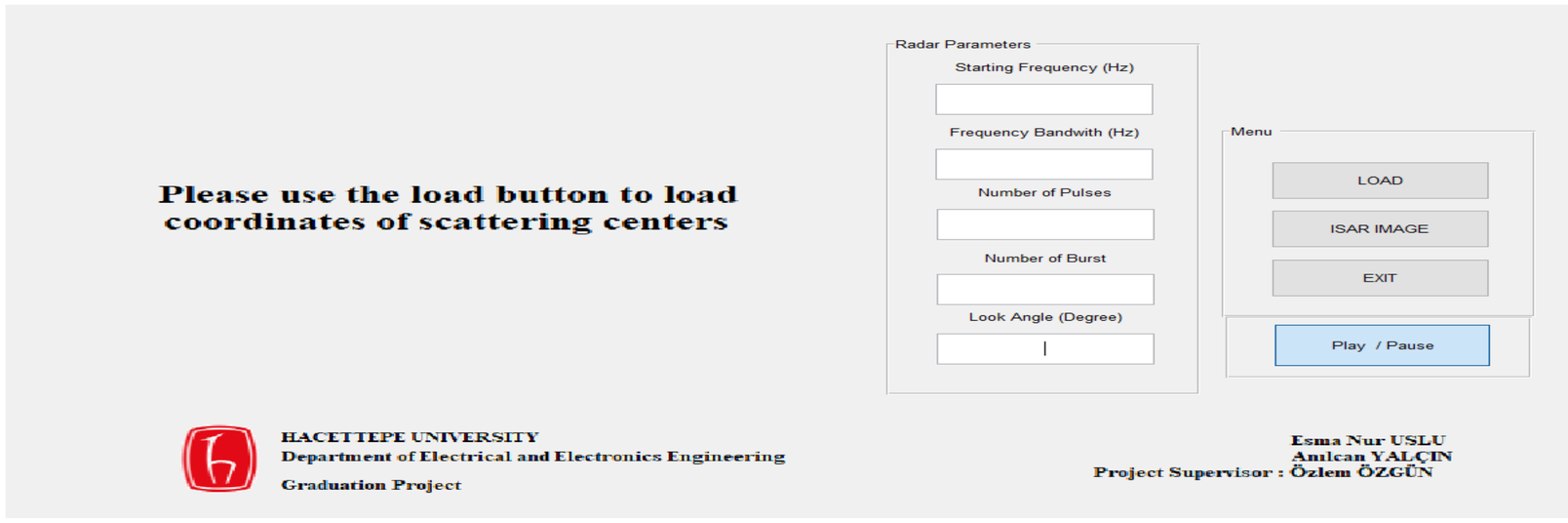
A Synthetic Aperture Radar (SAR), is a coherent mostly airborne or spaceborne sidelooking radar system which utilizes the flight path of the platform to provide finer spatial resolution than conventional beam-scanning radars.

SAR images have applications in many areas such as remote sensing of the surfaces of the earth and other planets, Volcano and earthquake monitoring, oil spill, flooding, urban growth, global change and military surveillance.

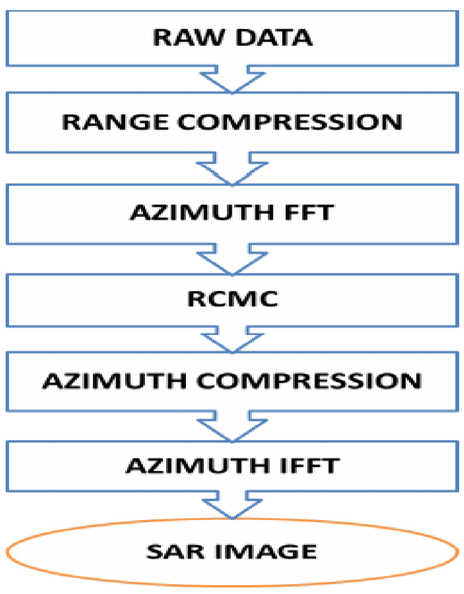
The purpose of this project is to develop a software tool with a user-friendly GUI for SAR/ISAR imaging.



Solution Methodology

The Range Doppler algorithm is one of the techniques used in transforming raw SAR data from the previous steps into a more useful SAR image. It was used in creating the first digitally processed spaceborne SAR data; it is still widely used today and also considered highly precise and the most efficient SAR processing algorithm. The simplicity of RDA comes from the fact that the dimensions of the raw data are separable due to the large difference in time scales; azimuth time being in the range of hundreds of m/s and range time in the range of the speed of light.

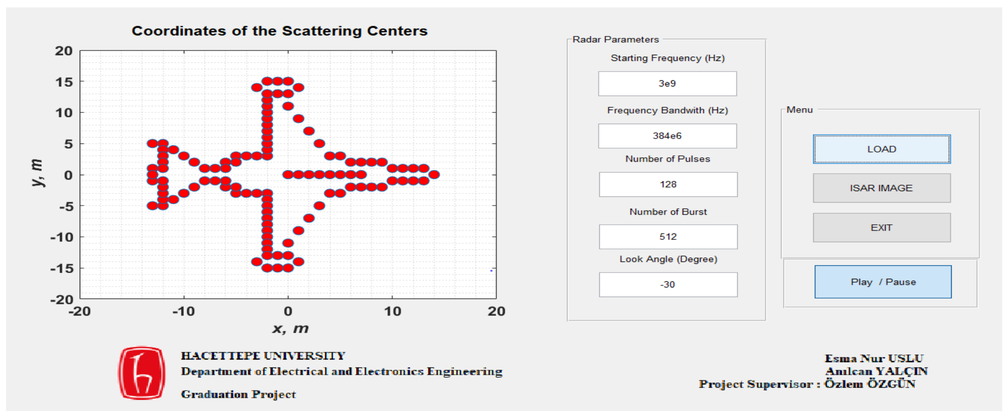
Range Doppler algorithm is the most common algorithm for SAR processing which provides reasonably good accuracy of result. As described in the theory of this algorithm, The main steps of RDA are:



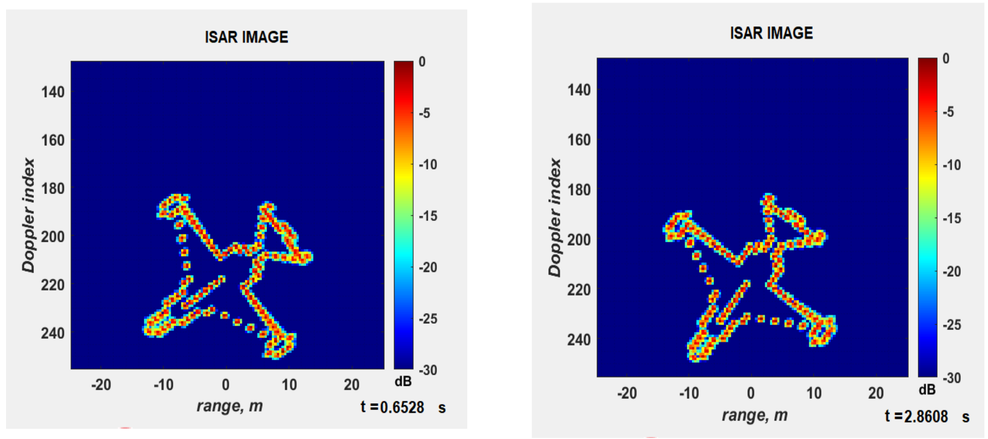
When it comes to implementing the code for this algorithm this is what exactly it takes:

1- Defining auxiliary data and parameters
2- Converting data to 2D frequency domain
3- Creating Match filter and performing Range Compression
4- Performing Range Cell Migration Correction
5- Converting Range Compressed data to Range-Doppler domain
6- Creating Match filter and performing Azimuth Compression
7- Returning data to Time-Domain
8- Visualization of results

RESULTS



Range-Doppler ISAR image will be obtained to identify the moving target. The target has both radial and rotational motion components. The target is assumed to be composed of perfect point scatterers of equal magnitude as the locations of these scattering centers. Then, the ISAR image was obtained by entering these parameters on the MATLAB GUI and loading the coordinates of the scattering centers of the target. According to the entered radar parameters, the ISAR image is obtained. 2D ISAR images were obtained for different time snapshots. The motion of the object is obtained by displaying 9 different snapshots one after the other in the interval from t = 0.2848 s to t = 3.2288 s. By adding the Play / Pause button, it was possible to pause the ISAR image and play again.



2D ISAR images were obtained for t = 0.6528 and t = 2.8608

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