Software to Generate 3-Dimensional Displays of Inverse Synthetic Aperture Radar Data

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Summary

• The Problem
  • Identifying Scatterers
• Introduction to ISAR
  • Principle of Operation
  • Geometry
• Software
• Example
• Conclusions & Plans
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**Standard Form 298 (Rev. 8-98)**
Proscribed by ANSI Std Z39-18
SAR
Synthetic Aperture Radar

Moving Radar

Stationary Target

ISAR
Inverse Synthetic Aperture Radar

Stationary Radar

Rotating Target
The ISAR Plane

Top View of ISAR for 0 Degrees Elevation
Location of Scatterers by ISAR

- Range
  - Distance from Radar
  - Calculated from time of flight of echoes
- Cross Range
  - Distance Left or Right from Vertical Plane Defined by Turntable Axis and Vector from Radar to Turntable
  - Calculated From Doppler Shift of Echoes Caused by Rotation on the Turntable
Angular Positions of Radar and ISAR Viewer

Elevation

$$\theta_{ISAR} = 90^\circ - \theta_{Radar}$$

Azimuth

$$\alpha_{ISAR} = 180^\circ - \alpha_{Radar}$$

2-D Location of Hot Spots
3-D ISAR Visualization Software

- Operates as a Stand Alone Program, not as a (Faceted Region Editor) FRED utility
- Written in C using SGI GL
- Display Windows
  - ISAR Movie Window
  - CAD Model from ISAR Point of View
  - Textured CAD Model from Arbitrary Point of view

3D Mapping of ISAR Data
Image Alignment

ISAR Image

Alignment Instructions

CAD Model

4X Zoom

Alignment Completed

Texture Image

CAD Model
Texture Mapped onto CAD Model

CAD Model with Texture

ISAR Image

CAD Model

Hot Spot on Turret

Hot Spot on Turret
Hot Spot on Tracks

Close Up of Track Hot Spot
Conclusions

- The 3-D ISAR visualization software aids in the identification of scattering centers on a ground combat vehicle.

Future Work

- Convert to Open GL
- Operation on a Windows PC
- Multibounce Display from Hot Spots
- Summation of Textures from Several Azimuth Angles