16207

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

Report Documentation Page

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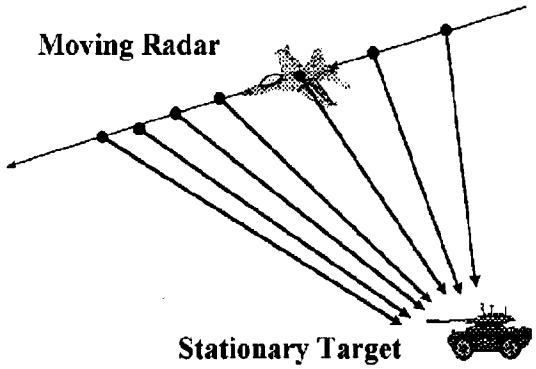
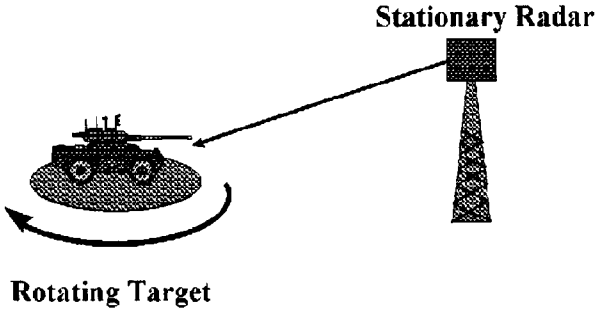
SAR

Synthetic Aperture Radar

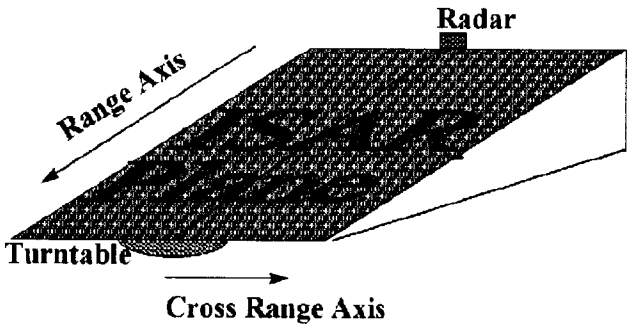


ISAR

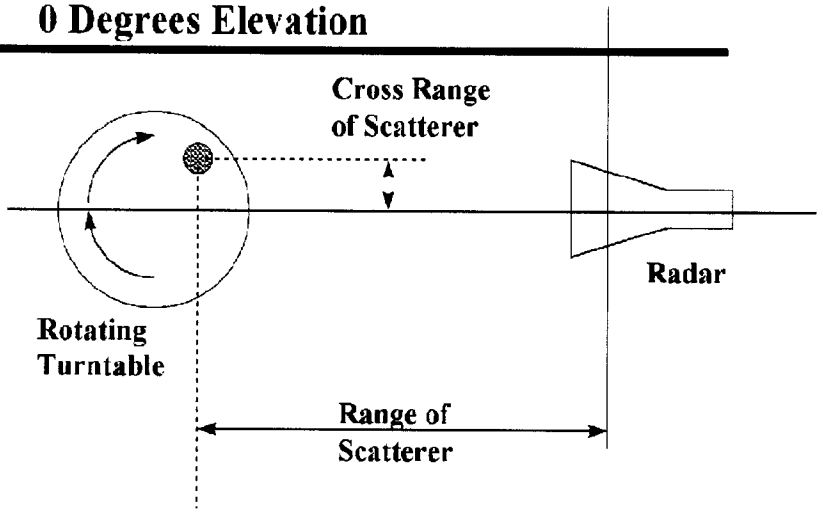
Inverse Synthetic Aperture Radar



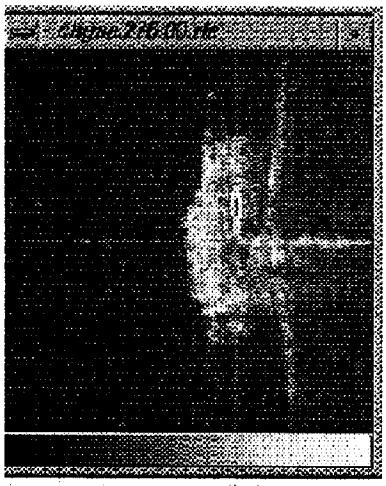
The ISAR Plane



Top View of ISAR for 0 Degrees Elevation



Typical ISAR Image



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

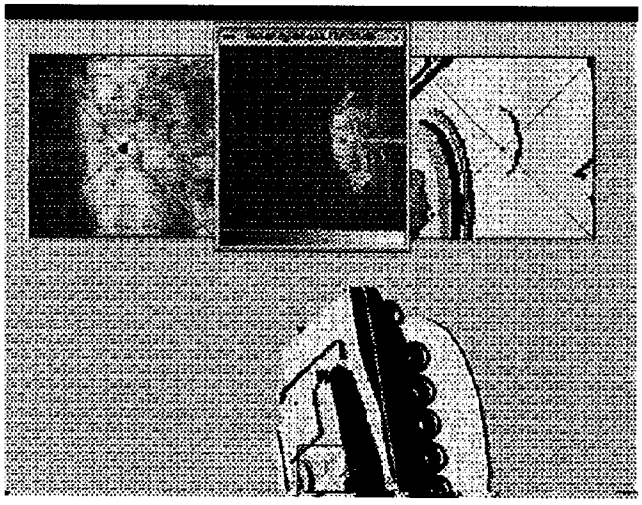
Elevation

$$\theta^{ISAR} = 90° - \theta^{Radar}$$

Azimuth

$$\alpha^{ISAR} = 180° - \alpha^{Radar}$$

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

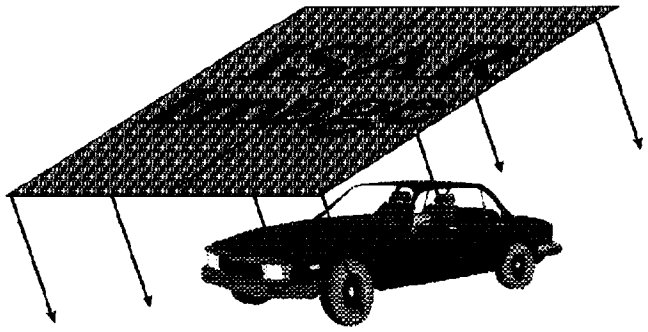
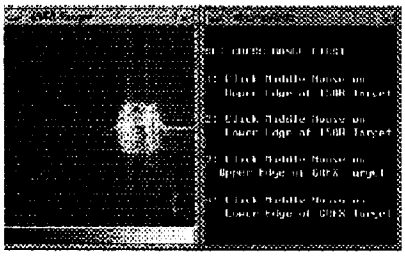


Image Alignment

ISAR Image



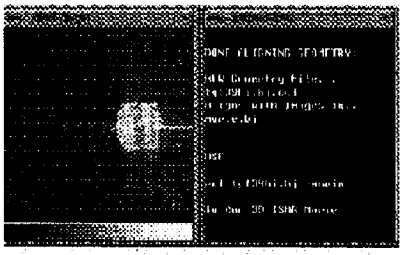
Alignment Instructions

CAD Model

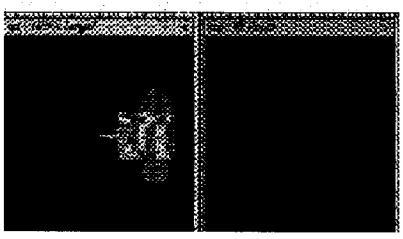
4X Zoom

Alignment Completed

Texture Image



CAD Model

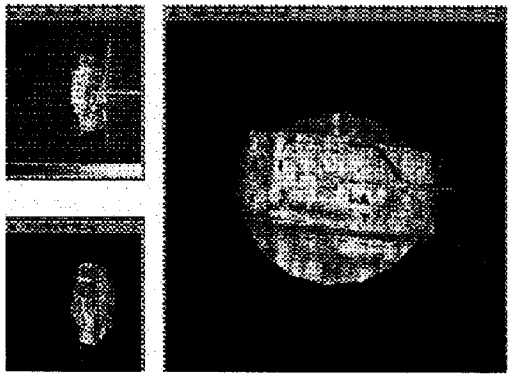


Texture Mapped onto CAD Model

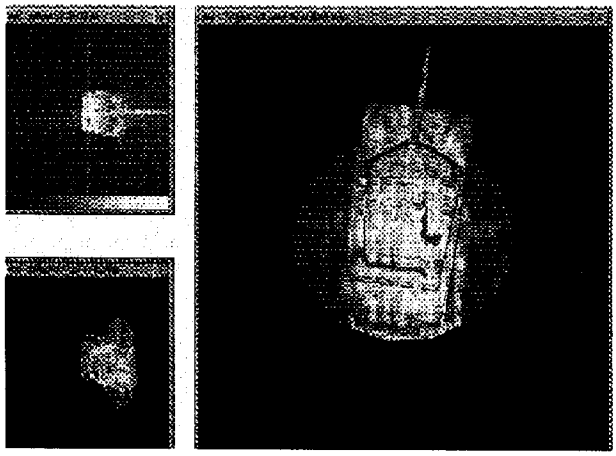
CAD Model with Texture

ISAR Image

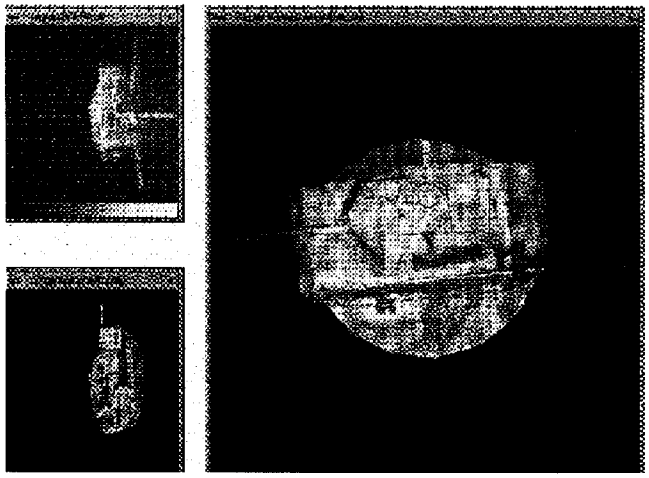
CAD Model



Hot Spot on Turret



Hot Spot on 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