

1-1-1979

A Digital Processor for the Production of Seasat Synthetic Aperture Radar Imagery

John R. Bennett

Ian G. Cumming

Follow this and additional works at: http://docs.lib.purdue.edu/lars_symp

Bennett, John R. and Cumming, Ian G., "A Digital Processor for the Production of Seasat Synthetic Aperture Radar Imagery" (1979).
LARS Symposia. Paper 316.
http://docs.lib.purdue.edu/lars_symp/316

This document has been made available through Purdue e-Pubs, a service of the Purdue University Libraries. Please contact epubs@purdue.edu for additional information.

Reprinted from

Symposium on

Machine Processing of

Remotely Sensed Data

June 27 - 29, 1979

The Laboratory for Applications of
Remote Sensing

Purdue University
West Lafayette
Indiana 47907 USA

IEEE Catalog No.
79CH1430-8 MPRSD

Copyright © 1979 IEEE
The Institute of Electrical and Electronics Engineers, Inc.

Copyright © 2004 IEEE. This material is provided with permission of the IEEE. Such permission of the IEEE does not in any way imply IEEE endorsement of any of the products or services of the Purdue Research Foundation/University. Internal or personal use of this material is permitted. However, permission to reprint/republish this material for advertising or promotional purposes or for creating new collective works for resale or redistribution must be obtained from the IEEE by writing to pubs-permissions@ieee.org.

By choosing to view this document, you agree to all provisions of the copyright laws protecting it.

A DIGITAL PROCESSOR FOR THE PRODUCTION OF SEASAT SYNTHETIC APERTURE RADAR IMAGERY

JOHN R. BENNETT AND IAN G. CUMMING

MacDonald, Dettwiler & Associates, Ltd.,
Richmond, B.C., Canada

With the launch of Seasat-A in June, 1978, the first spaceborne Synthetic Aperture Radar data was made available to the remote sensing community. While the mission only lasted 3½ months, a large volume of SAR data was recorded during this period, and recent image production is beginning to show the remarkable clarity of the data.

Synthetic Aperture Radar processing requires that many hundreds of operations be done per output pixel, and this high computation load has been handled in the past by optical computing techniques. While optical techniques have been very successful, they possess several limitations that digital processing can hope to improve. The limitations include the limited dynamic range and resolution of film recordings, the light diffusion in optical systems, the difficulty of achieving automatic focussing and the inability to cope with artifacts in the data.

An experimental digital Seasat SAR processor has been built at MDA which has demonstrated that Seasat images can be produced to the full resolution and dynamic range inherent in the SAR data. This paper will outline the digital processing steps in that processor from the reception of the raw digitized SAR signal data to the production of a final digital image tape.

The principal problem in the design of a data processor for spaceborne SAR data is the phenomenon of range cell migration. This refers to the fact that as individual reflectors are traversed by the illuminating beam, their slant range variation greatly exceeds the width of one range cell or the range resolution. In the satellite case, earth rotation, satellite attitude variations, and the extreme distances inherent in the earth/satellite geometry all combine to magnify the range cell migration extent to proportions

considerably in excess of that normally encountered with airborne platforms. This phenomenon couples the range and azimuth encoding in the SAR signal data and has required the development of new signal processing algorithms to reconstruct the SAR image.

In this paper, the problem of range cell migration correction is addressed in the context of azimuth look extraction and compression via fast convolution.

Sample Seasat imagery produced by the processor are included.

Copies of this paper in its entirety will be available for distribution at the symposium.