Daniel Topa <daniel.topa@ertcorp.com>

RE: [Non-DoD Source]

6 messages

BONITO, NELSON A GS-13 USAF AFMC AFRL/RVB <nelson.bonito.1@us.af.mil> Tue, Apr 21, 2020 at 9:19 AM
To: Daniel Topa <daniel.topa@ertcorp.com>
Cc: Ye Men <ye.men@ertcorp.com>, Trevor Crawford <trevor.crawford@ertcorp.com>, Christopher McGeorge <christopher.mcgeorge@ertcorp.com>, Eric Lahti <eric.lahti@ertcorp.com>, "BONITO, NELSON A GS-13 USAF AFMC AFRL/RVB" <nelson.bonito.1@us.af.mil>

Dan,

I appreciate your detail provided in the report. This report should continue to be expanded as we learn more about the RCS implementation approach. I like the summation which represents your earlier desire for working in the Fourier domain. The Fourier domain out performs the Taylor in capturing the overall structure with less coefficients necessary to represent the RCS features in azimuth. The frequency dependent function (Taylor) has multiple compromises applied which introduce greater errors in both frequency and azimuth. Using the frequency dependent function would result in a significant increase in coefficients, since the granularity in azimuth would need to be finer. I've restated your Table 13 in a chart below for the finest azimuth frequency dependent, which further states your assertion for the azimuth dependent Fourier approach.

	Azimuth	Elevation	Frequency	
Min	0	5	3	
Max	360	45	30	
Resolution	1	5	1	
Number	360	8	27	
Total Points				77760
Azimuth Function	8	8	27	
Total Coefficients				1728
Frequency Function	360	8	8	
Total Coefficients				23040

Revising the table above for a decimated azimuth using averaging in azimuth:

	Azimuth	Elevation	Frequency	
Min	0	5	3	
Max	360	45	30	
Resolution	12	5	1	
Number	30	8	27	
Total Points				6480
Azimuth Function	8	8	27	
Total Coefficients				1728
Frequency Function	30	8	8	
Total Coefficients				1920

The chart above shows with the decrease in accuracy (residual error in RCS increased, report figure 8) the number of coefficients are equivalent.

The remaining concern is the computational load at the browser. I suspect leveraging the storage of cosine results can resolve the problem to just multiplies. The Taylor approach is just a sequence of multiplies too.

One final agreement with your Fourier azimuth dependent approach is the analysis of the frequency dependent has shown the closest frequency provides a reduced error when compared to fitting to the frequency domain with a Taylor. This should be captured in the report. Demonstrating the azimuth dependent results versus the frequency dependent as a difference spectrogram will show the advantage of using azimuth dependent. You can demonstrate the frequency domain using an average of 5 degrees. This shows an increase in coefficients by more than 2 and still not retaining the resolution of the MOM data.

You'll also notice I've asked for multiple elevations (5 – 45 degree at 5 degree resolution). I'd like to see the current 30 degree data produced (your Fourier azimuth dependent) into a table for testing a few JS routines.

Thanks

Nelson

From: Daniel Topa <daniel.topa@ertcorp.com>
Sent: Monday, April 20, 2020 2:22 AM
To: BONITO, NELSON A GS-13 USAF AFMC AFRL/RVB <nelson.bonito.1@us.af.mil>
Cc: Ye Men <ye.men@ertcorp.com>; Trevor Crawford <trevor.crawford@ertcorp.com>; Christopher McGeorge <christopher.mcgeorge@ertcorp.com>; Eric Lahti <eric.lahti@ertcorp.com>
Subject: [Non-DoD Source]

Nelson:

The RCS summary report is attached. Much of the story is told visually in charts. The goal was to accentuate what was done and leave details of how it was done to other documents.

Your satisfaction is paramount, and we are happy to provide rewrites or further reports.

Dan

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Daniel Topa

Computational Physicist

Earth Resources Technology

Daniel.Topa@ertcorp.com | https://www.ertcorp.com

505 270 2560 (cell)

Air Force Research Laboratory

AFRL/RVBXC

3550 Aberdeen Dr SE

Bldg 570 | Rm 2320

Kirtland Air Force Base

Albuquerque, NM 87116

Daniel Topa <daniel.topa@ertcorp.com> Tue, Apr 21, 2020 at 11:07 AM
To: "BONITO, NELSON A GS-13 USAF AFMC AFRL/RVB" <nelson.bonito.1@us.af.mil>
Cc: Ye Men <ye.men@ertcorp.com>, Trevor Crawford <trevor.crawford@ertcorp.com>

Nelson:

Thanks for taking the time to pose things so succinctly. We look forward to working through these action items.

Dan

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BONITO, NELSON A GS-13 USAF AFMC AFRL/RVB <nelson.bonito.1@us.af.mil> Wed, Apr 22, 2020 at 9:38 AM
To: Daniel Topa <daniel.topa@ertcorp.com>
Cc: Ye Men <ye.men@ertcorp.com>, Trevor Crawford <trevor.crawford@ertcorp.com>, "BONITO, NELSON A GS-13 USAF AFMC AFRL/RVB" <nelson.bonito.1@us.af.mil>

Dan,

I'd like to see a little review on the Fourier number of coefficients. Most of your presentation material has focused on using 8 values to represent the RCS versus azimuth with errors below 1.0 m2 error. One of your slide decks showed the fit versus the data and how it improves with "d". You used 3MHz frequency which seems to be the less stressing of the set, but maybe not. I'd like to know how the Sciacca plane does for all frequencies and how many confidents for each frequency. A few of the concerns and questions.

1) Does this mean all frequencies result in the need for 8 coefficients?

2) Does the number of coefficients decrease with frequency?

3) Does the body shape result in another level of error?

Speaking about body shapes.

1) The analysis performed generates another interesting question regarding the simple ship. I'd like to see a shape that is semi-flat rectangle with a pyramid on top. Even adding detail with a bow and stern shape would be a good basic ship.

2) What is the size difference between the Sciacca plane and your B20 plane?

3) What do the two planes actually represent (ex. B20 is something like a B52)?

4) What happens when the Sciacca plane is doubled in size?

On the topic of details.

1) You've generated multiple reports each with details regarding my questions above. I'd like to begin compiling these into an overall report about this effort. The report can show some detail regarding the Mercury MOM problems, but it should focus on MOM output RCS values. A discussion on the meshing used is enough about the MOM-vis problems. The conversion into a mean RCS is a key section. The MOM-exe operation along with how to take a defined shape into the frequency/azimuth/elevation data and the processing to get the Fourier coefficients.

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Daniel Topa <daniel.topa@ertcorp.com> Wed, Apr 22, 2020 at 10:05 AM
To: "BONITO, NELSON A GS-13 USAF AFMC AFRL/RVB" <nelson.bonito.1@us.af.mil>

Nelson:

Great questions! Working away...

Dan
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Ye Men <ye.men@ertcorp.com> Wed, Apr 22, 2020 at 2:08 PM
To: Daniel Topa <daniel.topa@ertcorp.com>, Trevor Crawford <trevor.crawford@ertcorp.com>

Hi Dan,
Taking Nelson off the email thread for now.
A lot of good feedback from Nelson. I admit that my interest in RCS is also going up every day. Let us have a TIM (Trevor, Chris, and you and I). I agree that we need to consolidate all reports that you had together.
You will be busy with RCS for a while since your report seems to have generated some interest from other AFRL stakeholders.

Ye

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Ye Men
Technical Lead / System Architect, ERT, Inc.
14401 Sweitzer Lane, Suite 300
Laurel, MD 20707
301-323-1415 (Phone) | ye.men@ertcorp.com | www.ertcorp.com
301-361-0645(fax)

Daniel Topa <daniel.topa@ertcorp.com> Wed, Apr 22, 2020 at 2:46 PM
To: Ye Men <ye.men@ertcorp.com>

Ye:

You have been an integral part of this success story and I look forward to you continued insight and inspiration.

Dan

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