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## Compiled Messages

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**Subject:** hw3 **Topic:** Default Topic
**Author:** Griffin Rowell **Date:** October 23, 2011 6:54 PM

Hey all, I've been staring at this first problem and it's not going too quickly for me. I don't have any idea about the doppler, but I am getting an idea about the phase right now I have that the A for phase is A=f1^2*f2^2/(f2^2-f1^2)*(lamda1*phi1-lambda2*phi2).

The tricky part for me is getting it in radians. So for phi1 I get :
lamda1*phi1=lamba1*phi*+A/f1^2

I don't know if I need any 2*pi in there, but I was just trying to match up the powers of lambda. Did anyone else get anything similar?

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Patrick Mc Cormick **Date:** October 24, 2011 2:34 AM

I just started the homework too. I'm more focused on the project plan and literature review at the moment, it's due at the end of the week according to his old schedule. (am I right? the beginning of this course was a blur since I was busy at work)

So, for the ionospheric free phase, I was at first confused by the Prof's notes. Is there a single phase that is synonymous with the iono-free pseudorange? Or are there multiple?

I believe the answer is the latter ... you have to choose a scale factor to get the ionospheric free measurements for both L1 and L2 by scaling to their respective frequencies.

... at least that's how I interpret this ...

I arrived at this by going back to the definition of phase and doing a difference of the two multiplied by their frequencies, namely

f_L1*phase_L1 - f_L2*phase_L2 = (big long equation)

Once you fill a page full of algebra, you should get an equation on the right hand side that looks familiar. It's the carrier phase equation again! Sorta ... divided by an ideal frequency and 2*pi... with some detritus leftover by the integer cycles * frequencies ... .

I won't spoil the fun ... work out the algebra and if you run into trouble, check this out ... I used this to confirm my answers:

http://www.gmat.unsw.edu.au/snap/gps/gps_survey/chap6/642.htm

And also refer to the attachment. It's a presentation I found by doing a Google search on "ionosphere-free carrier"

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Attachments: GPS_Primer.ppt

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Vikas Vatsa **Date:** October 24, 2011 9:49 PM

To derive the ionosphere-free carrier phase I pretty much did the exact same thing as was used to derive the ionosphere free pseudorange derivation in the notes on page W8&9-36-37. I was careful to NOT directly compare phi_L1 and phi_L2 like the Professor warned and instead compared phi_L1*lamda_L1/(2*pi) and phi_L2*lamda_L2/(2*pi) like the professor wanted. It becomes clear why you want to compare it to those values when you look at the units of A.

I ended up getting the following after all the algebra:

phi_star=4.5294*phi_L1-3.5294*phi_L2

Anyone else got something similar?

Thanks,

Vikas

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Griffin Rowell **Date:** October 24, 2011 9:56 PM

Yes I did, but I think there is something with wavelength in there. It looks like you will have {lamda1(phi_ionfree1)+lamda2(phi_ionfree2)}/(lamda1+lambda2) so you can get it in meters.

Now on to doppler. I haven't even seen doppler. Time to search the notes.

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Griffin Rowell **Date:** October 24, 2011 10:22 PM

Is anyone multiplying this by c? The equation in the book has a factor of c I can't figure out. It does give m/s so if that's all we are trying to do then ok.

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Peter Edelman **Date:** October 24, 2011 11:01 PM

Hi everybody,

Finding phi* the same method I get

phi* = f1^2/(f1^2-f2^2)*phi_L1 - f1*f2/(f1^2-f2^2)*phi_L2 or

2.5457*phi_L1 - 1.9837*phi_L2

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Griffin Rowell **Date:** October 25, 2011 11:41 AM

Thanks Peter. I got the same.

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Patrick Mc Cormick **Date:** October 25, 2011 2:23 PM

Yes, this is my ionosphere-free measurement expressed in wavelengths of L1.

The equation for ionosphere-free measurement expressed in wavelengths of L2 is similar:

Phi*_L2 = f2*f1/(f1^2-f2^2)*phi1 - f2^2/(f1^2-f2^2)*phi2

Expressing in either is acceptable and removes the ionosphere effects from both carrier frequencies.

Interestingly, if you do the generalized derivation, you can realize that you can express it in any wavelength you want ... but typically it's expressed in wavelengths (or frequencies ... same difference) of L1 or L2 or something else GPS related.

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Vikas Vatsa **Date:** October 25, 2011 9:28 PM

I got what you guys got now. Thanks a million for that link Patrick, I don't think I would have figured out the nuances of expressing the ionosphere free measurement in terms of wavelength with just the notes.

Thanks!

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Adam Harden **Date:** October 26, 2011 12:46 AM

Hi everyone,

I need a bit of guidance.

I'm trying determine the ionosphere-free carrier phase at the moment and getting nowhere. The first thing I'm trying to do is determine the factor of A. I'm setting up something similar to what we did for pseudo-range:

phi_L1 = phi_star + A/fL1
phi_L2 = phi_star + A/fL2

But obviously that just yields the same A we arrived at before. Do I need to multiply the phi_L1, phi_L2, and phi_star by some lambda/(2*pi)? Is this even the correct way to go about this? The notes aren't particularly helpful here...

I've also looked at using the carrier phase equation on page W7-33 and tried subtracting

2*pi/lambdaL1 * phi_L1 - 2*pi/lambdaL2 * phi_L2

All that seems to provide though is the difference in ionospheric delays (times c) plus the different in ambiguity factors (times their respective wavelengths). I feel as if this should not be as bad as I've made it to be, but I'm not really sure where to go.

Can someone point me in the right direction? (Btw, I tried reading Patrick's links, but the website is illegible to me and the PPT didn't help much either...)

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Peter Edelman **Date:** October 26, 2011 12:02 PM

scale one of the carrier phases (phiL1 or phiL2) by either of the frequencies (fL1 or fL2) and subtract the two and solve for either the ionosphere free L1 or L2 carrier phases. It doesn't matter which one you find, I asked the prof.

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Adam Harden **Date:** October 26, 2011 3:14 PM

Ah, that would be my problem then. So I can scale either phi_L1 and phi_L2 by the same wavelength (over 2*pi, of course)?

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Adam Harden **Date:** October 26, 2011 3:57 PM

Alright, so I choose to scale by lambda_1. Following the pseudo-range derivation:

(lambda1/(2*pi)) * phi_L1 = (lambda1/(2*pi))*phi_Star + A/f1^2
(lambda1/(2*pi)) * phi_L2 = (lambda1/(2*pi))*phi_Star + A/f2^2

When I do this and solve for phi_Star (after solving for A):

phi_Star=(f1^2/(f1^2-f2^2))*phi_L1 - (f2^2/(f1^2-f2^2))*phi_L1

This is the same thing I had before with psuedo-range, which I don't believe is correct. I was expecting to see an additional factor of f1 in there somewhere.

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Adam Harden **Date:** October 26, 2011 5:14 PM

Alright, after some rework and additional understanding, I end up with:

phi_Star=(f1^2/(f1^2-f2^2))*phi_L1 - (f1*f2/(f1^2-f2^2))*phi_L2

which looks correct.

Out of curiosity, has anyone else tried to plot the geometric range against the psuedo-range and the carrier-derived psuedo-range?

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Rizwan Qureshi **Date:** October 27, 2011 5:47 PM

Hey Adam,

I am stuck almost at the same point where u were getting stuck.

Right now I have these TWO equations:

phi_1 = 2pi/lamda_1 * [phi_1_star + A/f1^2]

phi_2 = 2pi/lamda_2 * [phi_2_star + A/f2^2]

where phi_1 and phi_2 are in dimensions of Radians right now. If I convert above 2 equations into dimensions of DISTANCE as Prof told us to, then I get: Phi_1 and phi_2 in dimensions of DISTANCE are:

phi_1_in_meters = [phi_1_star + A/f1^2]

phi_2_in_meters = [phi_2_star + A/f2^2]

Now this is where I am stuck. I can solve for A and I did try to do what Peter told me, (i.e. f1* phi_1_in_meters - f2* phi_2_in_meters ) but I get 0 = 0 once I implement this.

Could u tell me if u were getting stuck on this too and what did u do different that resulted in the answer that u got. Ur answer is matching with others, so I am doing something fundamentally wrong here.

Thanks!
Rizwan

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Benjamin Martin **Date:** October 27, 2011 9:49 PM

What sort of "additional understanding" helped you arrive with the correct form? I too am coming up with

phi_Star=(f1^2/(f1^2-f2^2))*phi_L1 - (f1*f2/(f1^2-f2^2))*phi_L2

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Griffin Rowell **Date:** October 27, 2011 10:37 PM

This is what I got. i was under the impression that we were agreed on this answer?

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Griffin Rowell **Date:** October 27, 2011 10:36 PM

Working on the clock bias with phase did you all just plug phi* in phi=1/lambda*(r+c*Tr)? This seems like the only way to equate the two, but this doesn't account for the n term at the end.

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Griffin Rowell **Date:** October 27, 2011 11:20 PM

Sorry for the double post, but I think I am a little confused about turning the phase and doppler into range rates. For phase I am thinking we take either the L1 or L2 phi* and multiply by lambda. To get range rate just use diff like on pseudorange.

For doppler I really don't know. Would you just find the lambda associated with this and then differentiate that?

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**Subject:** Re:hw3 **Topic:** Default Topic
**Author:** Peter Edelman **Date:** October 28, 2011 8:10 PM

I think with Doppler you use fD = -d(rho)/dt*1/c to get the range rate. Don't quote me on this though, just a first guess

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In Reply to: Re:hw3

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