The Inverse Problem PhL 12.10.16

I am unhappy with my presentation of this subject for several reasons.

First, what is my statement of "the Forward Problem" ?

In Fig 1 Frame S is at rest, that is true. I fail to say in my Fig 1 discussion that Frame S is fixed to the paper. I should add something there maybe, and say it is the forward problem.

The first use of the word "forward" is at the start of Section 12. I imply that Sections 6.7.8 and 11 were all about this forward problem which I never really defined. Let's scan a bit

1.1 either frame could be at rest
1.2 same
1.3 same
1.4 same
1.5 same
1.6 concerns ($d\mathbf{a}/dt$) = $\boldsymbol{\omega}$ x $\mathbf{a}$ and uses $\boldsymbol{\omega} \equiv d\boldsymbol{\varphi}/dt$, but either frame could be rotating I guess
1.7 notion of ∂_S versus $\partial_{S'}$, either frame could be at rest.
1.8 notations for time derivatives.
What about the ang mom section here? Seems frame motion neutral.
1.9 neutral
1.10 commutation? neutral
2. G Rule. Is written as $\partial_S \mathbf{a} = \partial_{S'} \mathbf{a} + \boldsymbol{\omega}$ x $\mathbf{a}$ so you obtain a Frame S thing on the left, but I think the discussion here is neutral.
3. observer discussion is neutral, though I do say only if inertial do you have F = ma.
4.1 Fig 4.1.1 has Frame S at rest relative to paper. Frame S' is rotating.
4.2 Just a new picture of same thing. Frame S at rest rel to paper, Frame S' is rotating.
4.3 about b, think OK
4.4 Special Case 1: I think Frame S could move, as long as I don't do F = ma things are neutral.
4.5 Special Case 2
4.7 turntable. Here Frame S really is at rest.
4.8 Earth. here Frame S is really at rest.
4.8 camera platform seems neutral.
5. Here I state the Goal which I should call the Forward Problem. I think the equations that solve the Forward Problem allow that either or both frames be non-inertial!

6. Determ velocities. Trying to see why these equations allow either or both frames to be non-inertial. Ingredients are the G Rule and $\mathbf{r} = \mathbf{r}' + \mathbf{b}$. This entire chapter is valid even if both frames are non-inertial. In other words, the paper could be a non-inertial frame in Fig (4.2.1). The G Rule talks only about the relation between two frames, it does not require either frame to be inertial.

I have added a Comment in the G Rule section emphasizing that that Rule is valid even if Frames S and S' are both non-inertial. I think that is a helpful thing to put on the table.
I have added another Comments claiming that all the v and a relations derived in Section 6 are valid evern if both frames are non-inertial.

8.1 Here I state that Frame S is inertial for the first time so that F = ma.

8.7 I will later examine how inertial frame fits into this sun-earth discussion.

11.2 is where I first deal with ang mom L vectors and I use Fig 11.2.1.

If I were to not use F_{fict} and write things out, I would have

$$\mathbf{L}^{(c)} = \mathbf{L}'^{(c')} + m\,(\mathbf{r}'-\mathbf{c}') \times [\,(\boldsymbol{\omega} \times \mathbf{r}') + \dot{\mathbf{b}}_S] \qquad (11.2.14)$$

$$\dot{\mathbf{L}}^{(c)} = \dot{\mathbf{L}}'^{(c')} + m\,(\mathbf{r}'-\mathbf{c}') \times (\ddot{\mathbf{b}}_S + \boldsymbol{\omega} \times (\boldsymbol{\omega} \times \mathbf{r}') + 2\,\boldsymbol{\omega} \times \mathbf{v}' + \dot{\boldsymbol{\omega}} \times \mathbf{r}')$$
$$- m\,(\ddot{\mathbf{c}}' + \boldsymbol{\omega} \times \mathbf{c}' + \dot{\mathbf{b}}_S) \times (\,\mathbf{v}' + \boldsymbol{\omega} \times \mathbf{r}' + \dot{\mathbf{b}}_S) + m\,\ddot{\mathbf{c}}' \times \mathbf{v}' \,. \qquad (11.2.15)$$

where I have added the mass back in These equations are like $\mathbf{v} = \mathbf{v}'$ + other terms for the first, and like $\mathbf{a} = \mathbf{a}'$ + other terms for the second. I claim then that, since only the G rule and veloc and accel relations go into these results, they are both valid even of both Frame S and Frame S' are non-inertial frames!

Ang mom -- always show the mass:
1.8.11 is first appearance of ang mom. Added m here
Sec 11 return:
11.1 OK as is
11.2 OK, I think things are all fixed up here.

Section 12. Here then is where I first use the phrase Forward Problem. I make the point that both Frames could be non-inertial.
So I divide the Forward Problem into two sets of equations:

Group 1. Equations involving v, a and $\mathbf{L}^{(c)}$ which are valid if both frames are non-inertial
Group 2. Equations involving force and torque which are valid only if Frame S is inertial.

13. Here I now define the Inverse Problem. I only mention Group 1 equations here. For the inverse problem, Frame S is still inertial

Well, for this group Frame S is Inertial and Frame S' is not.

Added clarifying comment near start of Section 13 as to why F_{fict} and torque is NOT included in the lists which define the two problems.

I am now OK up to the start of Section 13.3.