Estimation Page Feedback

Notes: (MAIN ESTIMATION PAGE HERE)

1. It is mentioned that the propagation inputs are required from propagation but there could be a nice graph showing how these are related. How propagation is related to estimation in Tudat is quite vague when it is just mentioned in a text. **It is not clear how the propagation is associated with estimation in Tudat. I cannot understand how the two different code blocks, propagation and estimation are combined? Perhaps an example code like one line.**
    a. The variational equations are propagated
2. I find it very confusing when the user interfaces keep referring you to another page such as saying “can be shown here”. This is okay for big examples or big pieces of code but when it is just a list of parameters for instance at page (https://docs.tudat.space/en/latest/_src_user_guide/state_estimation.html) , it is mentioned that there is a parameter setup but it is not discussed what are these parameters.
    a. This is especially complicated because in literature parameter is a very broad concept.
    b. Suggestion: Below I present a suggestion on how the “parameter setup” text could have been improved

Solution (proposed):

> • **Parameter setup**: definition of the parameters (such as gravitational parameter, drag coefficient, or a radiation pressure coefficient of a body) that are to be estimated, as discussed here in the context of variational equation propagation.
> here —> for available parameters in Tudat
> here —> for …

3. It also gets very time consuming when in the main-page there is only one link. Because essentially, I would have to go through all the pages associated with estimation to keep looking for the link that I need.

   Solution (proposed):

   I know there is a tree available at right hand side but perhaps there can be a visual tool that shows how each component in the tree is linked or just a table of content sort of thing at the beginning of the main State Estimation page.

4. Also instead of listing the inputs and saying “here” the inputs itself can be hyper links so when I press “Paramerer setup” I should be able to go to the parameter setup apge directly. I think that would mitigate lots of confusion. (Problem + solution) - I also see that this is how it is done in State Propagation and I think it would be nice to have a consistency.

Notes: (This page)

1. There is a typo in parameter settings, it says “system sate” instead of “system state”.
2. The variational equations are indeed propagated however, they are more associated with estimation than propagation, therefore, perhaps they should be provided under state estimation, with the title variational equations only and then link back to the propagation? Because if someone is looking for the variational equations looking at propagation will not be their first move.

Notes: Estimation Settings (This page)

1. I believe it is confusing that the covariance analysis is defined under estimation settings. To begin with it is not an estimator. If I am not mistaken it is often implemented within the other simple estimators (such as a Kalman Filter) to analyze the covariance matrix.
   a. Perhaps it is difficult to attribute this function to another class or it requires unnecessary work. Then I would suggest to at least first introduce the Batch least-squares estimation and then the covariance analysis since it could mitigate the confusion of the reader.
2. I would also suggest to implement a kalman filter, there is already a covariance analysis which essentially estimates the covariance matrix within the Kalman

filter. Meanwhile the estimate of states can be obtained from the average of the system's predicted state.

a. It is true that for highly non-linear models, the Kalman Filter does not provide a useful answer but it could be a nice starting point for various analysis.

b. Also because the **Batch least-squares estimation** requires all the estimates to be stored (at least in a normal implementation) which could be computationally intensive. That being said, I think it would be nice if there were to be a clarification on how intensive is the Batch least-square estimation because if it is performed for long durations or heavy algorithms storing each estimation could be highly computationally intensive. Especially imagine if a precise orbit problem is tried to solve on board (perhaps a thesis topic).

c. Also at some point in performing the estimation section, we talk about normalization. I think it would make much more sense if this is identified directly under the covariance analysis section as it is related to that. As I mentioned before, I think, the more we make people switch between tabs the more complicated it gets to understand how the program actually works and think.

3. Full Estimation Settings title is empty and not entirely sure what should be identified there. Even if it is not a point that is relevant right now, I think it would be nice to indicate what will be done here like a TO DO, so that the reader knows what is missing at least.

Notes: Link Ends Setup (This page)

1. The sentence "Note that in Tudat, a planetary lander is treated identically to a terrestrial ground station." under the Ground Station Creation is very ambigious. It could be nice if it is identified in what way a planetary lander and a terrestrial ground station is treated indentically in Tudat? As vehicle objects or in terms of the way link ends are identified for these objects or the way they are created (which I assume is a ground station creation).
2. Maybe this is not really relevant but when `body_reference_point_link_end_id` is used to create a ground station on Earth, the second identified were points on Earth where there are actual ground stations. But should that be always the

case? Else can we write a random city or a location? - It could be nice to mention that perhaps

3. At the end of the page, when the example ends, `two_way_link_ends = ..` is left empty. It is very hard to understand what should come to point with … Even if it is a function that will vary depending on the specific problem at hand, an example could be given. For instance now, as a first time reader of this documentation, I have no idea what should come there.
4. Maybe this is more of a big request but I think it would be nice if at the beginning of each page there is a list with relevant objects and function that is associated with that object. Technically looking at the API this can be identified but I was thinking if this is provided at the beginning of the page like a simple callout (that links to API for further reading) it could be a lot clearer. (It would be clear what object is associated with what. I feel like for propagation this could also be done, although now that we know it is quite clear how propagation works but when we were learning a year ago it was quite complicated).