

TOGAC36_AMBF_R_AydinStab.docx

Stability Analysis and Review of Aydin et al. 2020 Transfer functions

This report will review the stability analysis for the Aydin et al. 2020 identified system from the system identification section 3. This effort was made to attempt to recreate figures 6 7 8 and 9 in their research. Unfortunately, using the method of closed loop poles analysis they described in the paper, we were unable to capture the same shape of their curves.

See the following MATLAB files for how this analysis was performed.

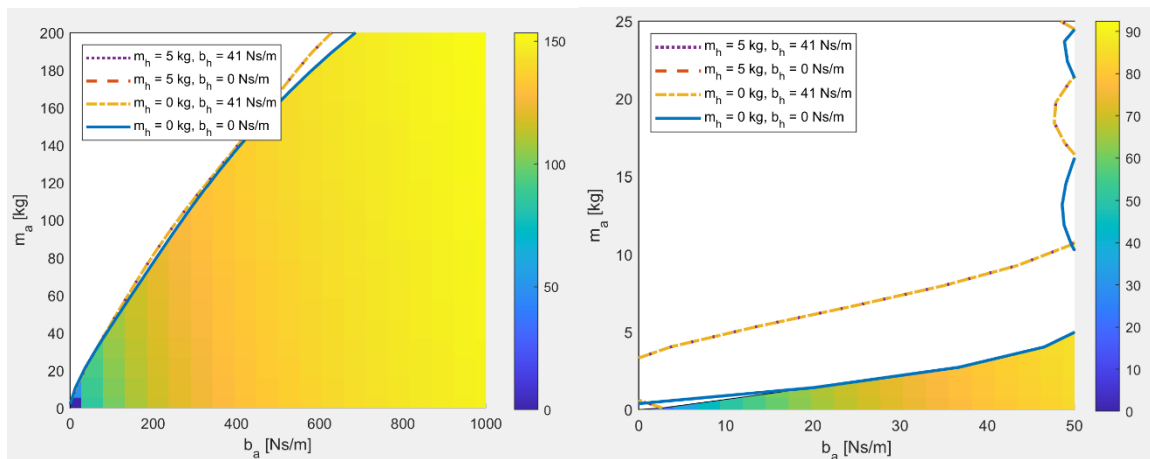
TOGAC24_MSD_TrueAydinetalStability.m

TOGAC26_AMBF_StepIdentifiedSystemStab.m

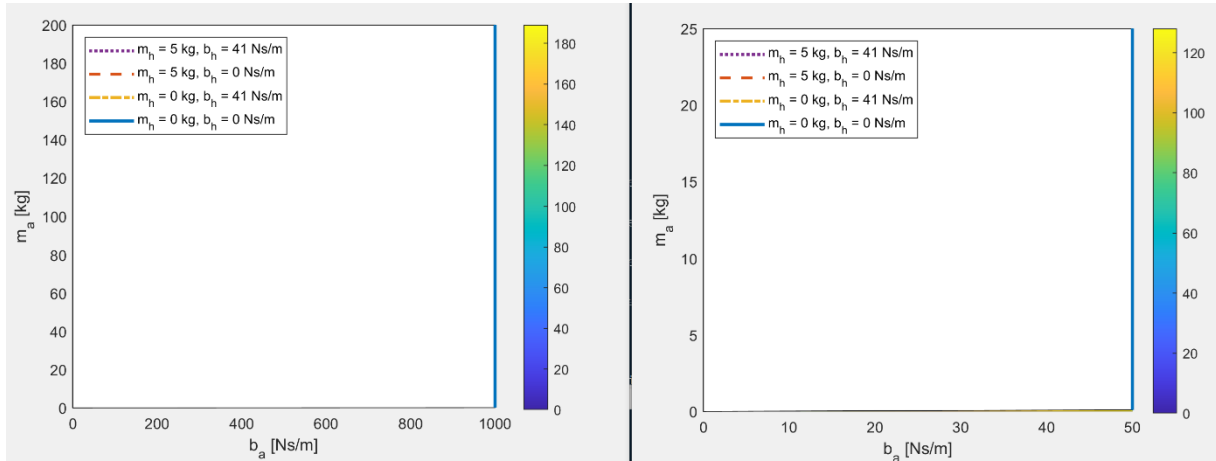
Closed loop stability analysis of closed loop poles

The following figures are stability maps with the transparency cost map underneath. Note that because the lines of stability were fit with a 6th order polynomial fit, in some areas unusual curvature is shown. For example in the first set of figures below, on the right hand side, we can see this sort of bouncing of curves on the right edge. This does not reflect the true stability behavior and is simply a mistake of the overfitting data. The true response is a continuing ramp of instability or a straight up and down line of instability.

On the left are the cases where the full human and environment impedances were considered. On the right were the cases only with the human impedance.

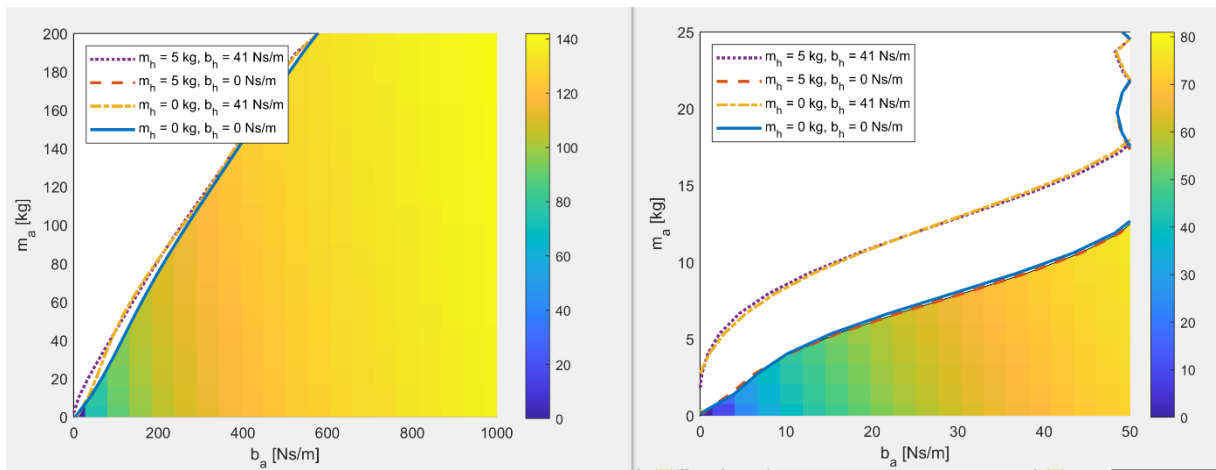


These figures are the stability analysis of $G(s)$.

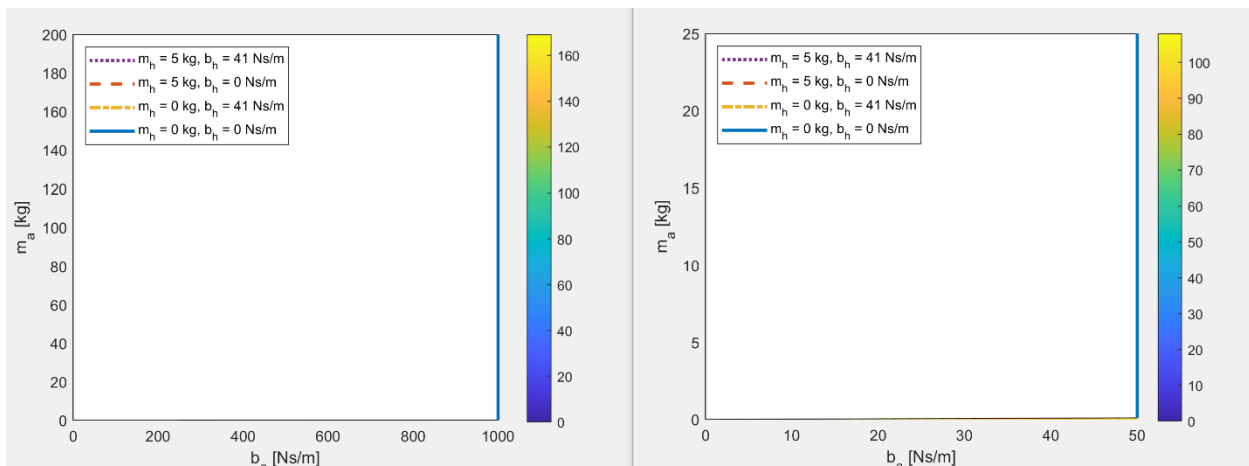


These figures are the stability analysis of T2(s)

No values are stable.

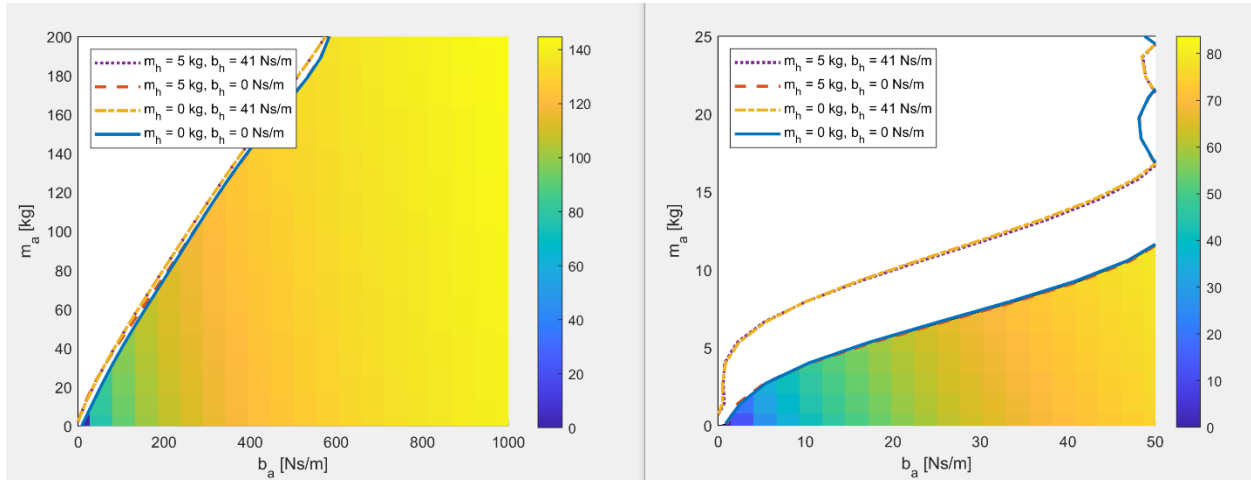


These figures are the stability analysis of T4(s)

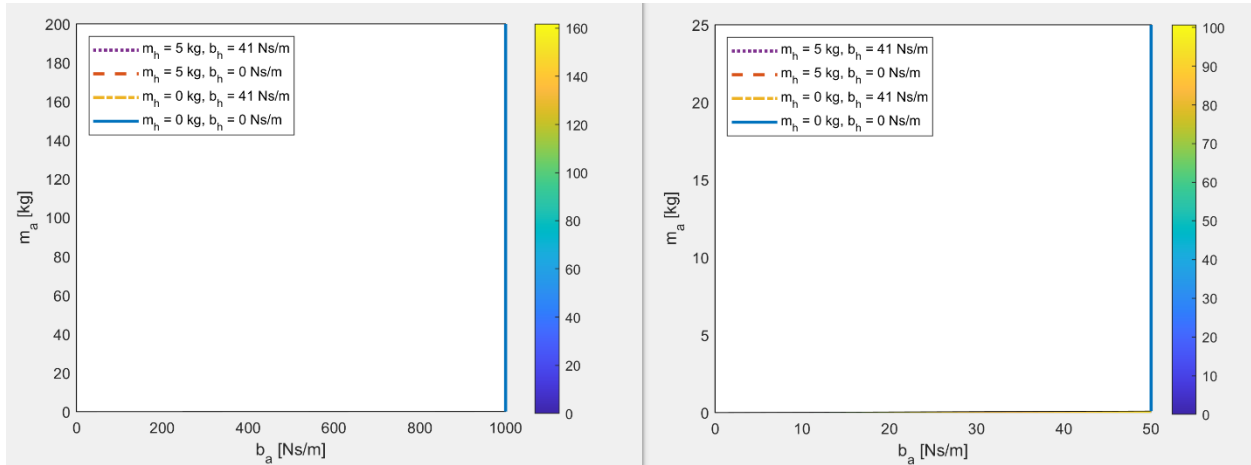


These figures are the stability analysis of T6(s)

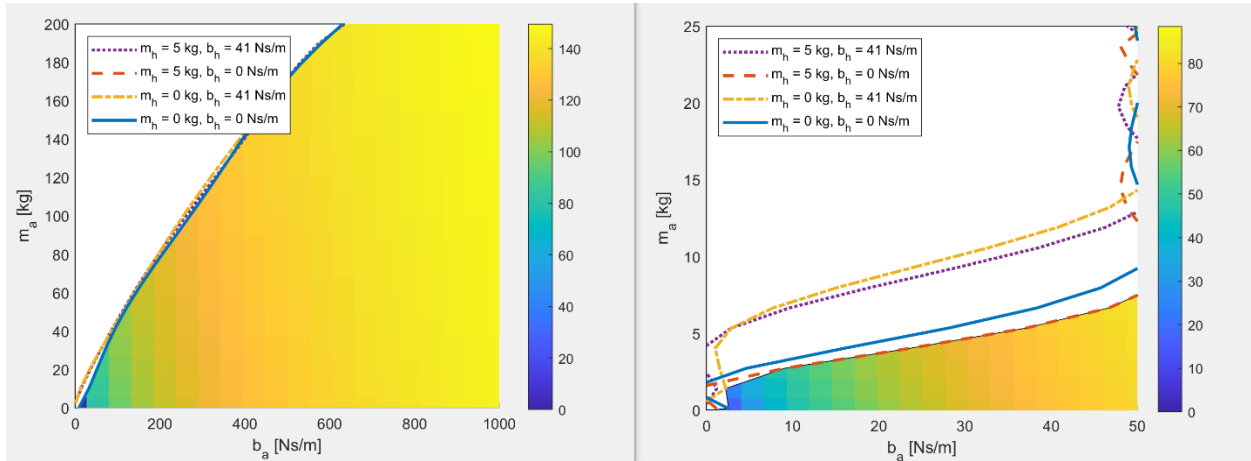
No values are stable.



These figures are the interactions of T2+T4 and their stability analysis.

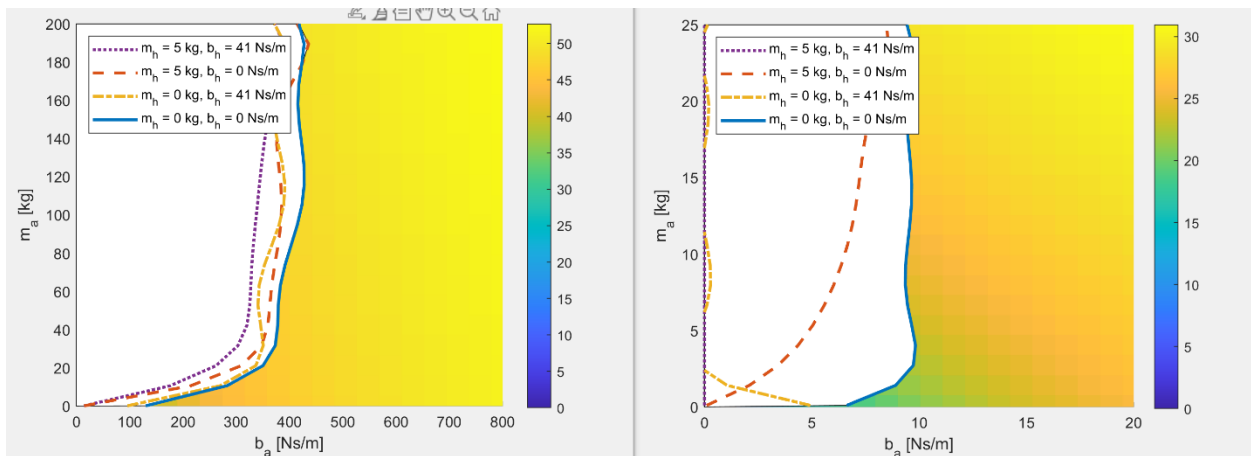


These figures are the interactions of T2+T6 and their stability analysis.



These figures are the interactions of T4+T6 and their stability analysis.

The results do not resemble that found in the Aydin et al. Paper. However, the using the same analysis techniques on our identified TF from the AMBF simulation yield these results.



And the expected stability and instability are observed in simulation using values in the stable and unstable reason. It is still unknown why we cannot achieve the same results found in the Aydin et al. paper.