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Finding the sweet-spot of a cricket bat using a mathematical approach

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December 11, 2015

To the External Examiner and the Internal Examiner

Revisions of Langton Rogers' Masters Dissertation

Firstly, I would like to express my gratitude for your recommendations and constructive criticism of my Masters' dissertation. It is clear from reading through both examiner reports that each of you put a number of hours and a lot of effort into the initial marking of the report and for that I am grateful. I truly appreciate your feedback and I trust I have incorporated it all sufficiently in order for my revised work to be of the highest possible quality.

Below, I outline the changes that I have made based on the recommendations of both examiners. Although there were not many changes, I believe I have taken your recommendations seriously and have thus spent many months revising my work to achieve a standard that I trust will be acceptable of a Master of Science degree.

As the changes required by external examiner were more complex in nature, I will begin by describing these. "Major Issue 1" raised by the external examiner discussed the flaw of the absence of real data in the work. This resulted in no significant meaning to the units of the results and there was no sensible scaling. Upon review of the report, I concur with the external examiner. In the revised work, I have incorporated real data and realistic values and parameters. The work is now presented with these data and values and I believe now satisfies the external examiner's requirement of seeing the models presented with as realistic results as possible. In particular, the values for the features of the bat (such as flexural rigidity and density) are now given realistic values found in literature, as recommended by the external examiner. Further, per the external examiner's recommendation, a table of these values has been presented.

Further, an issue of particular importance to the external examiner was the ratio of the ball contact time on the bat relative to the time taken for a wave to propagate throughout the length of the bat and return to the point of the collision. The external examiner raised this concern under "Major Issue 2". I once again concur with the external examiner on the importance of addressing this concept and have since incorporated his/ her argument on this ratio into my work. I have further supplemented the argument with a discussion from the work of Robert Adair. I trust all this discussed above will satisfy the revisions required by the external examiner for "Major Issues 1 and 2".

"Major Issue 3" raised by the external examiner dealt mainly with the concern of the dimensions throughout the work. I believe this issue has been resolved by introducing a discussion on the units of the parameters used in the model. Consistency of the units has been checked and I am confident that this concern has been addressed. Further, no characteristic values have been presented; all values used in the model are realistic and reasonable of a real-life scenario. It is noted that the examiner made a suggestion of an approach that could be used to address the concerns raised "Major Issue 3" but did further state that there was no requirement to take up this approach.

The concerns raised by the external examiner under the section "General Modelling Observations" have been addressed in the revised work. With regards to the batsman's grip on the bat being modelled as a clamped boundary condition, this limitation is now discussed in the revised work. It is noted, however, that with a sufficiently small ball-contact time on the bat, the ball will leave the bat before the signal generated by the collision returns to the point of the collision. This argument is supplemented by work of Adair and incorporates the external examiner's own argument of the ratio between these time scales. The concern regarding the lack of damping in the beam model and the fact that no energy is lost has been incorporated into the revised work. The discussion relating to strain energy has been adjusted accordingly. The conclusion that is arrived at states that a more sophisticated energy analysis of the entire system (not just that of the strain energy in the bat) is required for a better idea of the amount of energy in the batted ball.

The revisions suggested in the section "Corrections line by line" have generally been made in the revised work. Of particular importance, all references to an "inelastic collision" in the first scenario have been changed to "impulsive collisions".

Based on the required alterations of this work suggested by the external examiner, I have adjusted the conclusions arrived at in this work appropriately.

With regards to the changes required by the internal examiner; of major concern was that of the old Section 7, where the results were presented. The internal examiner was of the opinion that this section was difficult to read through and that the reader lost sight of the point of the work. Upon revision, I concur with this assessment and have since majorly revised this section. The results are now presented per *Location of Impact* as opposed to before where the results were presented per analysis. Further, I have significantly reduced the amount of text in this section and highlighted only main points, with a summary of each collision scenario presented. This is the new Chapter 6.

In relation to this, I have revised the old Section 6, which essentially introduced the types of analyses to be presented. I have incorporated this old section into the (revised) Chapter 3 (which discusses the model) and the new Chapter 6 (which presents the results).

As required by the internal examiner, I have further presented work showing the consistency of both numerical schemes and, along with revised stability analyses of both schemes, proved the convergence of these schemes.

Another concern of the internal examiner was that of the referencing in the project. I have spent time ensuring more sophisticated and acceptable referencing of sources. The internal examiner required that all mentions of "Sections" be changed to "Chapters", which I have duly done. All spelling and grammar mistakes indicated by the internal examiner have been corrected. All styling concerns (such as italics, use of upper-case and white spaces in the work) have been appropriately addressed.

Any and all errors encountered in the original work gave been appropriately corrected in the revised work.

I would once again like to thank you for your time and effort that you spent on my initial work as well as the time and effort that you will spend on my revised work. It is truly appreciated. I believe that I have gained a huge amount of experience from constructing (and subsequently revising!) my Masters dissertation. I have already noticed that the research and writing abilities I have developed are of huge help in my professional career. I have taken note of the impact of broader research, writing and general problem solving issues raised by you both and have since tried to incorporate these into my professional as a consultant at a leading global professional services firm.

With your agreement, and once this work is finally complete, I would really appreciate the chance to correspond with you both in a more casual environment with regards to any recommendations or thoughts that you may be willing to share with me.

I trust the revised work is now of the level required for the awarding of a Master of Science degree.

Thank you once again.

Kind regards,

Langton Rogers