April-June Progress Report

**Introduction**

Last quarter I was asked to match the visual shape of the stress-strain curve of the cohesive zone model portion of Beta with the stress-strain curve of the continuum damage model. We believed that the parameters given in literature for the cohesive zone model may need to be adjusted for our model and that the results from the continuum damage model were more reasonable. Therefore, the more ductile shape of the cohesive zone stress-strain graph was manipulated by altering the GIC value of the material to show a more brittle behavior. Once the overall shape was satifactory, we then proceeded to rotate our hexagonal single fiber-matrix mesh through 30 degrees in increments of 10 degrees to understand the behavior of each model. We found that at 30 degrees the strength was maximized and then began to decrease through futher rotation. After conducting this study, we found that the relative strength of the cohesive zone model is higher than the continuum damage model. Therefore, in order to properly compare the two models, we decided to match the relative strengths of each model by changing the strength paramter of the cohesive zones.

**Method**

I decided to start my strength matching study by setting the rotation angle of the same single fiber-matrix mesh to zero degrees (horizontal loading only) for both models. I used a simple linear interpolation to find the percent reduction of strength that matched the cohesive zone strength to the continuum damage model strength we are try to match. By iterating through this process, I was able to find the correct cohesive zone strength parameter that exhibits the same overall strength for the cohesive zone compared to the continuum damage model.

**Results**

After a few iterations of adjusting the percent reduction of the cohesive zone strength, I was able to reduce the relative error to just 0.05%. The percent reduction at this error is 59.5%. By looking at Figure 1 below, it can be seen the evolution of percent error to percent reduction.

Figure 2 shows the strength of each model at each iterations. As expected, the continuum damage model is constant while the strength of the cohesive zone model approaches that of the continuum damage model.

**Conclusion**

Matching the overall strength for the continuum damage model and the cohesive zone model is important to understanding the difference in results given by each model. Now that the cohesive zone strength is adjusted so that both models match, the next step is to rotated the cohesive zone model again to verify that the strengths match at each rotation angle chosen. The final step before true comparisons of the models can be made is to refine the GIC parameter and strenght parameter so that not only the strengths match, but also the energy dissapation.