Introduction: In cricket, there is an increasing trend to monitor the performance of the athlete. Busch and James (2007) and Portus (2004) are examples of performance monitoring of the batsman and the bowler. This study focuses on the batsman and involves the determination of the location of the “sweet spot” of a cricket bat. A model was constructed with the structural mechanics module and utilized the Eigenfrequency analysis study. Knowledge of the “sweet spot” is important in delivering an optimal shot that corresponds to the maximum power of the stroke.

Computational Methods: A 3-dimensional conceptual model of the cricket bat was constructed using the Structural Mechanics Module of the COMSOL Multiphysics software. The structural mechanics module analyzes deformations, stresses and strains of solid structures. Solid Mechanics was chosen since it is based on solving equations and computed results for displacement, stresses and strains of the cricket bat. In solid mechanics, the Eigenfrequency corresponds to the natural frequencies of vibrations and the Eigenmodes correspond to the normalized deformed shapes at the Eigenfrequencies. Eigenmodes and Eigenfrequencies of a linearized model are computed using the following equation from COMSOL:

\[ -\rho \omega^2 u = \nabla \cdot (s + Fv) \]

\[ s = S_0 + C : (\epsilon - \epsilon_0 - \epsilon_{inel}) \]

\[ \epsilon = \frac{1}{2} (\nabla u - (\nabla)^T) \]

Results: The following figures show the Eigenmodes and Eigenfrequencies of the cricket bat model. These Eigenmodes correspond to the normalized deformations of the cricket bat at the Eigenfrequencies. The Eigenfrequencies correspond to the natural frequencies at which these vibrations occur.

Conclusions: This study shows that the “sweet spot” can be located along the center of the bat, and is more concentrated in the lower mid region of the blade of the bat. Using this model of the bat, it can be concluded that the “sweet spot” is generally located in the region of 10 cm to 15 cm from the toe of the bat. This study can be improved with known dimensions of the cricket bat. Ultimately, it can inform the batsman in improving batting technique to deliver optimal shots.

References: