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2010 Mathematical Contest in Modeling (MCM) Summary Sheet

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The Determination of the “Sweet Spot” Base on Mechanics Simulation

It is well known that there is a sweet spot on the bat, and it plays an important role in baseball sport. In this paper, we address the problem associated with three main portions include the position of the sweet spot, the influences of the corked bat, and the differences among different materials bat. We consider two important models in hopes of solving the problems about the “sweet spot”.

The Plane Mechanics Model established by the **law of conservation of momentum** is to solve the three main portions. First, we analyze the direct impact of the ball and the bat, and then get the relationship between the speed of the batted ball and the hitting position, which makes sure the position of the sweet spot where is not at the end of the bat. This model denies “corking” a bat enhances the “sweet spot” effect without considering the corked bat easily controlled. Eventually, by using the existing data about the different materials bat we know the aluminum bat is better than the wood bat.

After presenting the above model, a **three-dimensional Computer Model** which can **randomly simulate** the process of athletes hit the ball in the ball park. From the simulation result, We get the range of batted ball and find the standard deviation of the range using the unmodified bat is larger than using the corded bat, this is why the corked bat prohibited. On the other hand, it explains the reason why the aluminum bat is prohibited by Major League Baseball is that using a aluminum bat is contrary to the principle of athletic, fairness and safety in the baseball games.

In conclusion, our algorithm is quite easy to implement and to solve the problem successfully. Though there remain some weaknesses in our model, it still has the significance for promoting to extensive use.