

Acoustics engineer's work helps take the sting out of baseball bats

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For aspiring major leaguers, one of the most painful aspects of learning the game is dealing with the sting of the bat's handle when a baseball is hit incorrectly.

"If you hit the ball in the wrong place, it creates a vibration that hurts,"

said Daniel Russell, professor of acoustics and director of acoustics distance education at Penn State.

But work by Russell is helping to soften the sting through a vibration absorber built into a bat's knob.

For the acoustics faculty member, the foray into researching [baseball](#) bat stings was an accident. As a physics professor at Kettering University in Flint, Mich., Russell sought a laboratory exercise to teach his students experimental modal analysis and its relationship with structural vibration.

"I needed a simple vibrating structure that students could completely study and analyze within a laboratory period," he explained.

"I had been using a rectangular beam," Russell said, "But it was too perfectly matched with what they learned in the classroom."

For something a bit more real world, he turned to baseball bats. "I could have the students learn the procedure, measure 35 data points and analyze the resulting frequencies and mode shapes within one laboratory class period."

After posting some animations of results on YouTube, he got a call from CE Composites Baseball Inc. and was asked to rank bats according to performance, based on vibration and acoustic measurements. His ranking was correct, and Russell provided experimental data as they developed their [baseball bat](#) line.

Since his collaboration with CE Composites, Russell's consulted with a number of major bat manufacturers, including DeMarini, Easton, Louisville Slugger, Nike, Rawlings and Worth, as well as branching out into other hand-held sports equipment, such as field and ice hockey

sticks, racquetball racquets and golf clubs.

Working with Marucci Sports, he helped to develop a vibration absorber that's built into the knob of some of their baseball bats.

"It's a bigger knob than most bats have," he explained. The tiny cylindrical device's diameter is a bit larger than a quarter. "It's a mass piece with a spring."

To measure the effectiveness of the vibration absorber, Russell hangs the bat upside down, attaching an accelerometer to the bat's grip. He then strikes the bat barrel with a hammer to determine the vibration decay.

"Typically a wood bat has a dampening rating of about 10, while an aluminum bat is a one," Russell said. A higher number is more desirable for the hitter.

With a correctly tuned vibration absorber, the damping rating shoots up to between 200 and 300.

The work has earned him the nickname "Batman" from his students and his office even features a few pieces from that other Batman.

The research has been patented, and Marucci's [bats](#) currently employ a second-generation vibration absorber from the work.

Provided by Pennsylvania State University

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