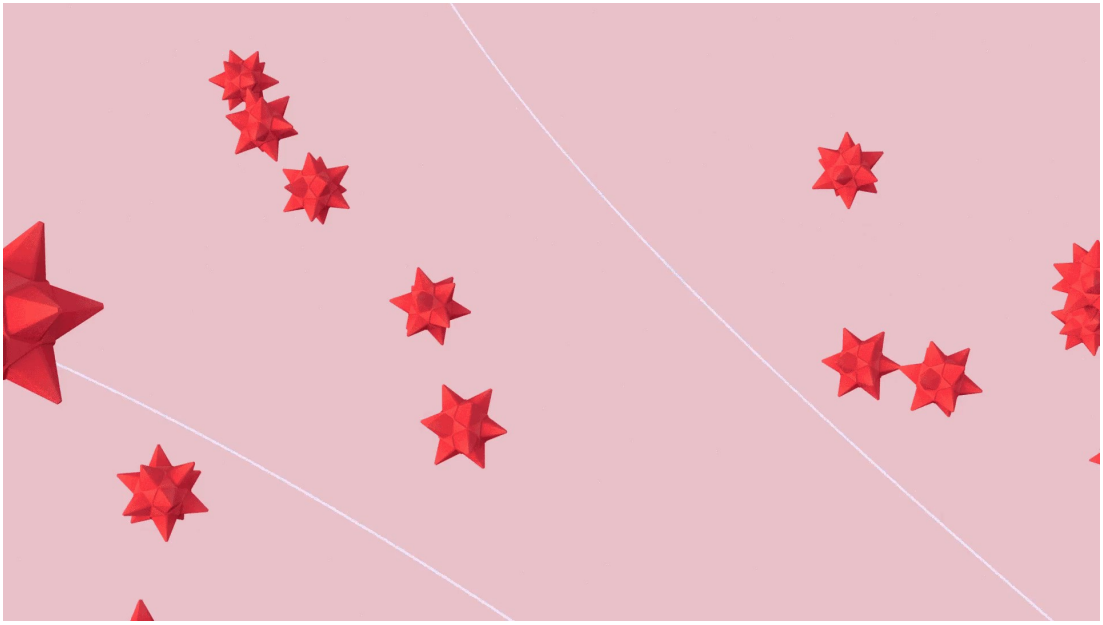
KEVIN HARTNETT SCIENCE 05.27.18 07:00 AM

A CLASSICAL MATH PROBLEM GETS PULLED INTO SELF-DRIVING CARS



A collision-free path can be guaranteed by a sum-of-squares algorithm. OLENA SHMAHALO/QUANTA MAGAZINE

Mathematicians contemplated a simple mathematical question. They figured it out, then laid it to rest—with no way of knowing that the object of their mathematical curiosity would feature in machines of the far-off future.

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The future is now here. As a result of new work by Amir Ali Ahmadi and Anirudha Majumdar of Princeton University, a classical problem from pure mathematics is poised to provide iron-clad proof that drone aircraft and autonomous cars won't crash into trees or veer into oncoming traffic.

"You get a complete 100-percent-provable guarantee that your system" will be collision-avoidant, said Georgina Hall, a final-year graduate student at Princeton who has collaborated with Ahmadi on the work.

The guarantee comes from an unlikely place—a mathematical problem known as "sum of squares." The problem was posed in 1900 by the great mathematician David Hilbert. He asked whether certain types of equations could always be expressed as a sum of two separate terms, each raised to the power of 2.

Mathematicians settled Hilbert's question within a few decades. Then, almost 90 years later, computer scientists and engineers discovered that this mathematical property—whether an equation can be expressed as a sum of squares—helps answer many real-world problems they'd like to solve.

"What I do uses a lot of classical math from the 19th century combined with very new computational math," said Ahmadi.

Yet even as researchers

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