Physicists aim to help golfers by producing better balls that fly farther

November 24 2008

At the 61st Meeting of the American Physical Society's Division of Fluid Dynamics this week, a team of researchers from Arizona State University and the University of Maryland is reporting research that may soon give avid golfers another way to improve their game.

Employing the same sort of scientific approach commonly used to improve the design of automobiles, aircraft, ships, trains, and other moving objects, the team has used a supercomputer to model how air flows around a ball in flight and to study how this flow is influenced by the ball's dimples. Their goal is to make a better golf ball by optimizing the size and pattern of these dimples and lowering the drag golf balls encounter as they fly through the air.

"For a golf ball, drag reduction means that the ball flies farther," says ASU's Clinton Smith, a Ph.D. student who is presenting a talk on the research on Sunday, November 23, 2008 in San Antonio. Smith and his advisor Kyle Squires conducted in collaboration with Nikolaos Beratlis and Elias Balaras at the University of Maryland and Masaya Tsunoda of Sumitomo Rubber Industries, Ltd.

It's no secret that dimples improve the flight of a golf ball. Once in flight, a golf ball experiences aerodynamic forces generated from the surrounding air flow as well as gravity. The latter constantly pulls it towards the ground, while the aerodynamic force in the direction of motion, or drag force, dictates the distance it travels. The main purpose of dimples is to reduce the drag and help the ball fly farther. Actually, dimpled golf balls experience about half the drag as those with no dimples.

Although the United States Golf Association (USGA) regulates the design of golfballs, laying out uniform size and weight specifications that all approved golf balls must meet, the dimple pattern is not regulated. It is one of the very few parts of the ball over which companies have freedom to change the design. But what pattern is best for lowering the drag?

Up to now, dimple design has been more of an art than a science. For many years, sporting goods companies would design their dimple patterns by simple trial and error, testing prototype after prototype against one another. The new study takes a different approach, asking how to design dimple size and pattern based on mathematical equations that model the physics of a golf ball in flight. Working out the solution to these equations -- even on the fastest personal computers today -- is not feasible since it would take more than 15 years of computing time just to get a glimpse of the flow around the golf ball for a fraction of a second.

Nikolaos Beratlis, a Ph.D. student at the University of Maryland, and his advisor Elias Balaras have been developing highly efficient algorithms and software to solve these equations on parallel supercomputers, which can reduce the simulation time to the order of hours. The number crunching for a typical computation, for example, takes approximately 300 hours using 500 fast processors running in parallel (normal desktop computers may have one or two slower processors).

The group's work presented by Smith in San Antonio will summarize their research. So far, they have characterized air flow around a golf ball at the finest level of detail ever attempted, teasing out the drag at each exact location and showing how air flows in an out of each tiny dimple on a golf ball's surface as it spins through the air during flight.

In the end, they produced a model that reveals the physics of a flying golf ball with the greatest level of detail ever seen -- the first step in achieving the project's long-term goal of optimizing dimple design to realize the lowest drag possible. The next step, says Smith, is to extend the work by comparing different dimple designs.

New designs are still years away at best, however, so don't give up the driving range just yet.

The talk, "Direct Numerical Simulations of the Flow around a Golf Ball: Effect of Rotation" by will take place on Sunday, November 23, 2008. Abstract: meetings.aps.org/Meeting/DFD08/Event/90118

Source: American Institute of Physics

Citation: Physicists aim to help golfers by producing better balls that fly farther (2008, November 24) retrieved 20 April 2024 from https://phys.org/news/2008-11-physicists-aim-golfers-balls.html