Rapid Aerodynamics Improvement Software Based on Innovative Drag Calculation and Polygonal Node Bifurcation

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For vehicles traveling at moderate to high velocities, aerodynamic drag can be the largest factor of wasted energy. Therefore, reducing drag to improve aerodynamic efficiency can lead to significant fuel savings. Currently, expensive wind tunnels and supercomputers are used, with engineers testing each slightly modified design individually. This project developed a versatile computer software that was able to aerodynamically optimize any three-dimensional object in any specified environment. In addition, due to this software's capability for mass-object testing, it proved far faster for low drag performance optimization than available methods. Published wind-tunnel data as well as Computational Fluid Dynamic (CFD) simulation trials verify the algorithm's accuracy for 3D compressible flow. This speed was achieved by introducing a more efficient drag-calculation algorithm instead of relying upon wind tunnels or the Navier-Stokes partial-differentials in order to be faster and lower cost. The software couples polygon node bifurcation with rapid evaluation of drag made possible by the innovative algorithm in order to gradually evolve any given vehicle or object to minimize its drag while preserving external details. This computer software was tested with the space shuttle, a golf driver club, and a wind turbine blade, among other objects and vehicles. The new optimized versions were shown have statistically significant drag reductions when compared with their corresponding original shapes, allowing such benefits as energy conservation and fuel efficiency.

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