Single and Simple Groove Addition Improves Propeller Efficiency

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Propellers are used in many fields. Improving propeller efficiency leads to solving energy problems. Conventional studies aiming at improving propeller efficiency normally focus on changing the shape of the blades. In this study, inspired by golf ball dimples, a method is proposed by which a propeller can be efficiently modified simply by adding a single groove to the surface of the blade. Over the course of this study, 120 different modified propellers were tested, and efficiency improvements were calculated by measuring the wind speeds. Through analysis of airflow around the blade using a smoke wind tunnel and analysis of the wind speed profiles, it is conjectured that the wing tip vortex suppression and the boundary layer separation were the major reasons for these efficiency improvements. The best achievement out of all the models was, a modified fan, which demonstrated a 32 % increase in the output efficiency. Including the outside efficiency, it increased by 26 % compared to a base (unmodified) fan. Furthermore, it is verified that the efficiency can be improved by modifying the position of a groove depending on the Reynolds number. These experimental propeller modifications were then successfully applied to an existing computer propeller, thereby improving its efficiency by 12%. Energy problems across the globe have been a significant issue and the present result may contribute to reducing energy consumption. I've achieved a low-cost method for improving existing propeller efficiency, which is suitable for home appliances, industrial and aviation applications.

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