Airplane Wing Gust Suppression by Active Flow Control

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The purpose of this project is to create an inexpensive, simple, and effective airplane wing gust suppression system that has the capability to reduce the accelerations associated with unstable ambient conditions by creating constant lift. Such a device has applications in the airline industry where it has already seen some success in increasing ride comfort, improving fuel efficiency, and increasing aircraft life. While previous designs were complicated, and expensive, this design will be inexpensive, and simple, while still being effective. The system works by sensing air velocity and angle of attack. This data is then sent to a micro controller. The micro controller maps the sensor data to a table of values obtained through wind tunnel testing, and uses a closed loop algorithm to determine what position the control surface must take so that the wing creates constant lift. The solution is then sent to a servo that moves the control surface to the correct position. The servo and sensors are mounted inside of a specially designed, 3D printed wing. To obtain the information needed for the data table, I modified the wind tunnel that I had previously built with a new, more accurate diffuser section, new lift sensor, and a force balance, made using a combination of 3D printed and non-3D printed parts. The system reduces the effect of gusts on lift by 56%. This system not only makes flying more comfortable, it makes it less expensive, and less wasteful.

Awards Won:

Third Award of $1,000