Plasma-Based Dynamic Stall Control on a Vertical Axis Wind Turbine

We have succeeded in controlling dynamic stall on a double-bladed vertical axis wind turbine (VAWT) model using pulsed dielectric barrier discharge plasma actuators. The azimuthal angles of plasma actuation initiation and termination, that produced the largest increases in power, were determined parametrically on the upstream half of the turbine azimuth. Experiments were performed in our low-speed wind tunnel at speeds of 5-7m/s. A mathematical model, together with instantaneous turbine speed, is used to estimate transient torque and power developed by the turbine under the influence of plasma actuation. A remarkable of this research is that a *net turbine power increase* of more than 10% can be achieved. We determined this by systematically reducing plasma pulsation duty cycles as well as the plasma initiation and termination angles. Furthermore, we have determined that further performance increases can be achieved by changing the actuators dielectric material, increasing the turbine radius and developing a method for control of dynamic stall on both the upwind (inboard of the blades) and downwind (outboard of the blades) halves of the turbine azimuth.