The wake effect is a phenomenon that arises when multiple wind turbines are situated in close proximity. As leading turbines attempt to extract the maximum possible amount of kinetic energy from the wind, they produce a region that is characterized by lower wind velocities. As a result, turbines located further downstream experience a deficit of kinetic energy and produce up to 60% less power. One method of mitigating this wake effect is to yaw wind turbines such that they are no longer facing the wind. This misalignment generates forces in the crosswind direction that cause the generated wake to deflect. With an appropriate amount of deflection, the low velocity wake would be manipulated in such a way that it no longer overlaps with downstream turbines. In the current paper, we implement this concept of yaw-based wake redirection using extremum seeking control (ESC) in a wind farm containing two wind turbines that are aligned with the wind. A constant wind speed is simulated with varying level of turbulence intensity in order to assess the effects of noisy measurements on the controller performance. ESC is a unique since it requires no mathematical model of the system being controlled. It is therefore a practical choice for a controller as wind farm aerodynamics are exceptionally difficult to model mathematically. Result show that the proposed control strategy has the potential to raise wind farm power output under steady and low-turbulence winds, while actually deteriorating performance at high levels of turbulence.

Themes:

Check (highlight) the most applicable theme according to the abstract.

| Innovation and Technology | Health and Wellness | Culture and Society | Sustainability and Conservation |

Comments:

Very good abstract, perfect level of technical material for this conference. Made a couple of very minor edits to language, mostly typos. Very interesting project.