Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

**Control strategies for wind farm power optimization: LES study**[1]

UMBERTO CIRI, MARIO ROTEA, STEFANO LEONARDI, Univ of Texas, Dallas — Turbines in wind farms operate in off-design conditions as wake interactions occur for particular wind directions. Advanced wind farm control strategies aim at coordinating and adjusting turbine operations to mitigate power losses in such conditions. Coordination is achieved by controlling on upstream turbines either the wake intensity, through the blade pitch angle or the generator torque, or the wake direction, through yaw misalignment. Downstream turbines can be adapted to work in waked conditions and limit power losses, using the blade pitch angle or the generator torque. As wind conditions in wind farm operations may change significantly, it is difficult to determine and parameterize the variations of the coordinated optimal settings. An alternative is model-free control and optimization of wind farms, which does not require any parameterization and can track the optimal settings as conditions vary. In this work, we employ a model-free optimization algorithm, extremum-seeking control, to find the optimal set-points of generator torque, blade pitch and yaw angle for a three-turbine configuration. Large-Eddy Simulations are used to provide a virtual environment to evaluate the performance of the control strategies under realistic, unsteady incoming wind.

[1]This work was supported by the National Science Foundation, grants no. 1243482 (the WINDINSPIRE project) and IIP 1362033 (I/UCRC WindSTAR). TACC is acknowledged for providing computational time.

Umberto Ciri
Univ of Texas, Dallas

Date submitted: 31 Jul 2017 Electronic form version 1.4