



**U.S. Department of Energy**  
**Energy Efficiency and Renewable Energy**

Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable



**Wind Energy Program Technology Portfolio**

**Low Wind Speed Technology Phase I: Advanced Independent Pitch Control**

**Advanced Energy Systems, Inc.**

**Project Description:** Advanced Energy Systems (AES) Inc. used inflow angle sensors to conduct a conceptual study of independent blade pitch control. The control strategy combined input from turbine states (rotor speed, rotor azimuth, each blade pitch) with inflow angle measurements (each blade angle of attack at station 11 of 15) to derive blade pitch demand signals. The controller reduced loads sufficiently to allow a 10% rotor extension and to reduce the cost of energy by 6.3%.

**Project Type:** Conceptual Design Study  
**Project Budget:** \$199,933  
**Industry Cost Share:** \$0  
**DOE Cost Share:** \$199,933  
**Planned Project Duration:** July 2002–July 2004

**Contacts:**

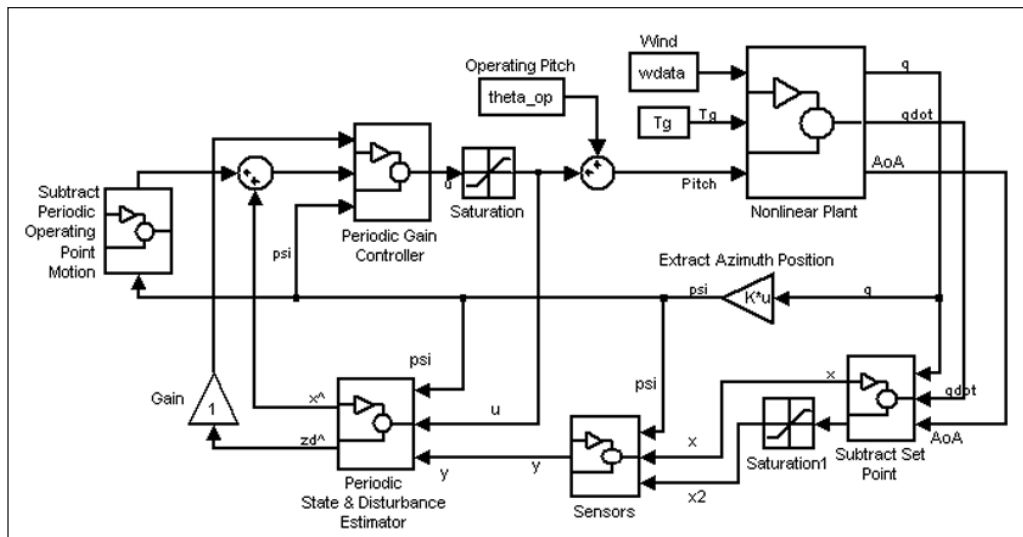
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**Current Status:** Project Complete—Final Report, Low Wind Speed Turbine Project Conceptual Design Study: Advanced Independent Pitch Control <http://www.nrel.gov/docs/fy05osti/36755.pdf>



**Proportional integral derivative control schematic for independent pitch control.**

**A Strong Portfolio for a Strong America** • Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

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