Senior Design Presentation

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PID Controlled Solar Tracker

Proportional Integral Derivative (PID) control is one of the oldest and most widely used industrial control methods **[Araki, 1984]**. A PID controller calculates an "error" value as the difference between a measured and a desired process variable. The controller attempts to minimize the error by adjusting the process control inputs using the error. The PID controller calculation (algorithm) involves three separate constant parameters, and is accordingly sometimes called three-term control: the proportional, the integral and derivative values, denoted by P, I, D. Heuristically, these values can be interpreted in terms of time: P depends on the present error, I on the accumulation of past errors, and D is a prediction of future errors, based on current rate of change **[Bennett, 1993]**. The weighted sum of these three actions is used to adjust the process via a control element such as the position of a control valve, a damper, or the power supplied to a heating element. In the absence of knowledge of the underlying process, a PID controller has historically been considered to be the best controller **[Bennett, 1993]**. By tuning the three parameters in the PID controller algorithm, the controller can provide control action designed for specific process requirements. Although this system is widely used, it still has some potential that seems to have gone unnoticed. By slightly altering the implementation of the PID controller, the same mathematical and programming structure can be used for motion tracking. Solar panels that track the sun's motion across the sky have been shown to harvest 30-40% more energy than fixed panels **[Araki, 1984]**. By changing conventional tracking systems to the new PID tracking systems, two-axis systems should be easier to program. Also, the PID system will keep the panel pointed at the brightest spot in the sky (where there is the most light energy to be harvested), even if it is not in the direction of the center of the sun or if it requires a lot of motion in order to find the position of the sun.

Araki, M. Control System, Robotics and Automation, PID Control, Vol II, 1984
S. Bennett, A History of Control Engineering 1930-1955, IEE Control Engineering Series 47, 1993.