Benefits of Controller Monitoring and Integrated PID Optimization

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The benefits of continual loop monitoring are becoming well known to industry. Controller monitoring can successfully find problem areas that will benefit the plant. However, is it important that the PID Optimization software be integrated with the performance monitor? This paper addresses the question.

A control monitoring package can be designed to take advantage of the powerful technology in a PID optimization package. With an integrated optimization package, during normal analysis of plant data, the monitor is constantly scanning the data for special data features. These data features allow model identification and control performance calculations on a continual basis. The monitor is scanning for a setpoint change in automatic or a controller output change in manual. With integrated optimization, the monitor is continuously and silently tracking opportunities for developing process models on a 24x7 basis.

The Old Way

Traditionally, making a scheduled bump to the controller output or setpoint and collecting data on the results must be carried out. This must be coordinated with process operations and the process control or instrument engineering department. Once the data is collected it must be validated. A model must be developed based on a decision about the form of the process. The resulting model needs to be further validated by playing the model data back thru process data to determine if the fit is sufficiently good to use the model for subsequent analysis and prediction.

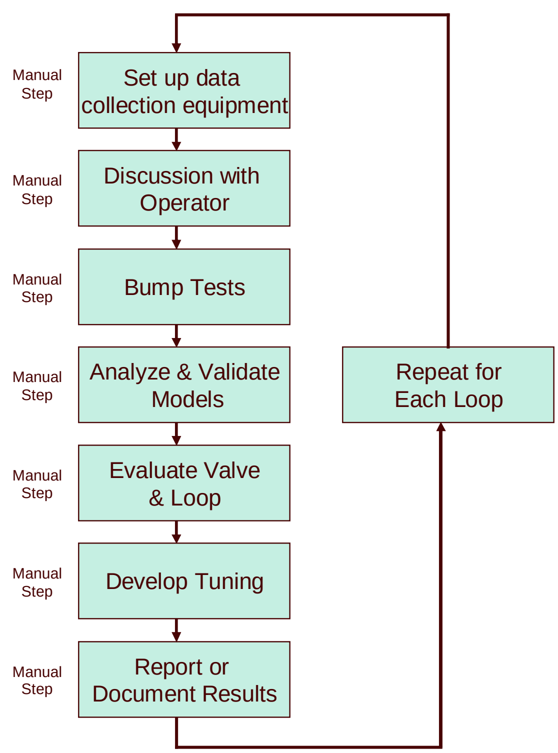

Figure 1
Traditional Approach

This traditional approach is a time consuming, manually intensive, and error prone process, which is rarely carried out on a plant wide basis. Figure 1 shows a flowchart of the traditional process for loop monitoring & tuning.

The New Way

PlantTriage performs all these steps on a continuous basis, for all the control loops in the plant. It looks for these special features in normal plant operating data that is acceptable for modeling. This streamlined and automated approach is shown in Figure 2.

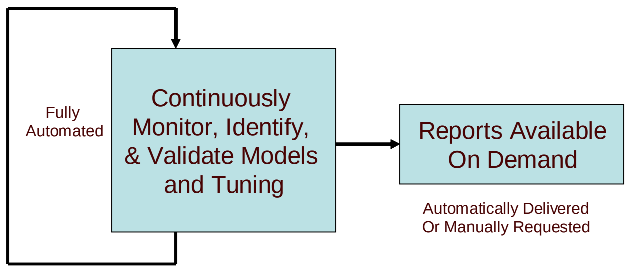

Figure 2
Modern, Integrated Approach

An Example of Direct Cost Savings From Integrated Optimization

Let's consider a typical process operation that has 300 active control loops. The time and steps required to collect data on say 20% of those loops or 60 loops would be as follows:

1.Connect tuning software: 15 min per loop. This includes entering the addresses, the range information, the controller type, controller action, the controller algorithm type and determining the OPC server and tag information. This 15 minute estimate assumes no human errors occur and all information is at hand for each loop.

2.Coordinate with operations to make the test, 30 min./loop

3. Carry out the test, 30 min/loop

4. Validate and analyze data, 1 hour per loop

5. Develop process control models and tuning, evaluate nonlinearities, signal filtering, objective of tuning, and impact on valve wear. 1 hour

Total, 3.25 hrs / loop * 60 loops = 195 hrs
195hrs * $80/hr cost* = $15,600

For the 300 loops in our example this would cost $78,000

*(Plant engineer resource including salary, benefits, assigned overhead costs etc. also referred to as a fully burdened cost. For an external consultant to perform this task would cost twice as much, but presumably the consultant would be more efficient so the cost would be similar.)

When the loop tuning and modeling software is fully integrated with the loop monitoring system the cost to develop the same information is $0 and is constantly being updated for an additional cost of $0.

Additionally, it may take several days or even weeks to mobilize the engineer or consultant. Because they have many other priorities, it may take some time before the right people can be available to gather the data. This is a "lost opportunity cost", because a loop tuning or valve performance problem may go additional weeks without being fixed, resulting in further operating problems.

Performance Indexes from Automatic Modeling

PlantTriage uses the information from the automatic modeling system to develop several metrics, which can also be used as Key Performance Indicators, or KPIs. Two example metrics are the ExperTune Index and the Relative Response Time.

ExperTune Index, EI, is a prediction of the control performance improvements possible if the control loop is retuned. The EI uses the information from the automatic modeling subsystem based on a reduction in the Integrated Absolute Error, IAE.

There are several available offerings in the marketplace, including PlantTriage, which can detect some form of oscillation. There are many controllers, upwards of 30%, that do not oscillate but have very sluggish and non optimal tuning parameters in the controller. In these cases the controller will be slow to respond and will have prolonged deviation from setpoint when a disturbance occurs. This will reduce the time to steady state, during which time plant profit is substantially reduced. The EI uses a model from the process developed from data and validated using our tuning engine to deliver a real world prediction of realistic improvements possible.

In many cases the Harris Index, HI, is promoted as a way to capture possible controller performance improvements. While ExperTune provides full support for this index in our product we feel that it has several major drawbacks. The HI is based on an assumed process delay time, bases its performance prediction on a Minimum Variance Controller model, and is insensitive to detuned controller conditions referenced above.

MVC is an academic controller form of which there are no known commercial implementations. The process model developed automatically from your process data and run through our tuning engine is the best and most practical approach to obtain controller performance predictions. Moreover, the EI will clearly identify those cases where sluggish tuning exists.

Relative Response Time, RRT, another ExperTune exclusive, is a measure of the controller characteristic period. If the control loop was modeled using the automatic modeling subsystem then PlantTriage calculates an RRT. The RRT is an essential tool to quickly decouple controllers whose harmonics are close to each other. These loops have coupling or interaction. Operators sometimes refer to this phenomenon with two or more controllers fighting each other or talking to each other. When this condition occurs, oscillations can ripple through a plant for many hours before they subside.

In some cases the only to way to eliminate the oscillations is to place one or several controllers in manual until the process settles down. During these periods operational targets are not achieved and energy is wasted due to the excessive cycling. The RRT is a way to quickly and proactively eliminate these conditions.

By using the integrated analysis tool within PlantTriage which in turn is enabled by the automatic modeling function it is possible to quickly separate the harmonics on two or more controllers such that the interaction is eliminated. By eliminating interactions, the process responds faster to upsets and reaches steady state four to five times faster. It is also more robust so that operational targets are sustained thru a wide range of conditions ensuring maximum profit.

For further details on this topic including additional assessments generated from the modeling subsystem included in PlantTriage follow this link.

http://www.expertune.com/ptwhitepapermodeling.html

Accessibility of PID Optimizer Software
There are ever increasing demands being put on today's engineers. Software that is not straightforward and easy to use will **not** be used. Analyzing a loop in detail should be only 1 click away. The easier it is, the more it will be used, and the more benefit the plant will achieve economically. Tight integration also avoids costly human errors. For example in the integration between the control monitor and the PID Optimizer software:

- The user should not have to re-enter any setup information or any OPC addresses. This saves time and can avoid costly human errors.
- The colors of the trends in the control monitor historian should be the same as the colors of the trends in the Optimizer software. This avoids costly human errors that can occur because someone was viewing an incorrect trend.
- The PID Optimizer software should be capable of being launched from the control monitor while viewing a historical trend of the process data.
- When the PID Optimizer software is launched, the same process data shown on the historical trend should appear in the Optimizer software, automatically.
- Any zoom or pan of any trend in the control monitor historian will contain data that can be automatically passed to the PID Optimizer software when it is launched.
- If the user is viewing multiple loops on the historian trends (as in a cascade for example), all the loops should be automatically configured in the PID Optimizer software, thus making it much easier to analyze all the loops that pertain to a specific problem being studied on the trend.

Each of the above items makes the Optimizer tool, much more accessible, easier to use, more likely to be used, and therefore that much more likely to be of benefit to the plant. PlantTriage satisfies all these requirements.

Conclusions

PlantTriage, from ExperTune, is unique in tightly integrating PID optimization technology with the control monitoring system. This integration is required to get the most out of controller monitoring. The benefits from having the two functions integrated are substantial. They include significant labor savings, human error reduction, and the development of essential performance assessments needed to quickly and efficiently optimize a process automation system.

PlantTriage™ by ExperTune®

Performance Supervision System

For more information, contact http://www.expertune.com