Shift Your Focus from Analysis to Optimization Using Active

Model Capture Technology

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Summary

Process Industries are scrambling to keep up with the increasing pressures of the global economy. There have been reductions in headcount, and more pressure to increase reliability, reduce cost, and increase productivity. More than ever, resources are focused on getting today's product "out the door". The most experienced resources, those who typically handle root-cause problem-solving and process improvement, have precious little time to investigate, prioritize, and analyze issues. Active Model Capture Technology automatically performs the most critical steps of problem-solving, allowing the key resources to focus on solutions and optimization.

Introduction

This paper is focused on leveraging the manufacturing plant's problem-solving personnel. This includes Process Engineers, experienced operators, maintenance personnel, and management. These individuals are called primarily to

1. Keep the process running at its best.
2. Find ways to improve the process

These problem-solvers tend to be expensive personnel, and they are generally in short supply. They have a high level of process knowledge, and there is a high "opportunity cost" associated with their time. That is, if their time is wasted, there are many opportunities to improve the process that will be lost.

This paper shows how the application of Active Model Capture Technology reduces the time wasted, and helps to focus the effort of these problem-solvers. It is typical to expect a 5-fold increase in effectiveness of these personnel when the proper tools are in place.

The paper is organized as follows:

1. Discussion of the typical problem-solving process
2. Automation of problem-solving with Active Model Capture Technology
3. Case Studies & Benefits

The Problem-Solving Process
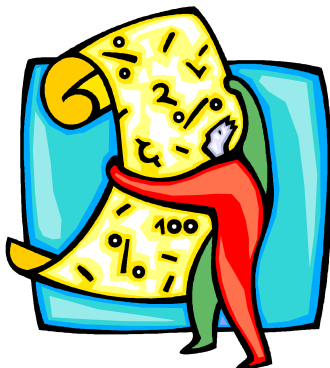
The typical problem-solving process consists of the following 8 steps.

Problem Identification (Analysis)

To solve a problem, you must first know that you have a problem. Process Engineers often scan through daily, weekly, or monthly charts, searching for problems. Because they may be responsible for multiple unit operations, and hundreds or even thousands of key parameters, the engineer does not have time to look at all potential problems and their

root causes. They might typically follow only those process variables that they believe are the most important. Subtle problems on critical systems may go unnoticed for months because they do not get routine attention, or there simply isn't enough time to dig deeper.

Preliminary Data Analysis

The preliminary data analysis is focused on understanding the problem. This may involve gathering trend data, comparing against a base period, calculating changes, calculating assessments, and charting the results. The preliminary analysis could take hours or even days. This all assumes that the right data is being considered.

Problem Prioritization (Analysis)

After the preliminary analysis, the operations team must decide how this problem fits with the many other priorities it faces. This question of relative priorities must address a combination of factors, such as the severity of the problem, the relevance of the particular system to be fixed, and the relative economic importance of this part of the process.

Detailed Data Analysis

Once it is clear that the problem-solver should dig into a particular problem, he must start analysis in detail. More data must be gathered, trended, crunched, and analyzed. The problem-solver may look closely at several aspects of the problem, based on his prior experience. However, it is likely that they may not look at all of the relevant facts. It is extremely important to be able to define exactly when a problem started.

Identify Probable Causes (Analysis)

After looking at the data, start to identify possible causes. If the probable cause is upstream or in a related system, then more data must be gathered and analyzed.

Test Probable Causes (Analysis)

Testing probable causes to determine which is correct involves validating the data, trying to re-create the problem, and other investigative techniques.

Identify Solutions (Optimization)

Now that all of the data crunching is complete, the focus shifts to solving the problem. This may involve equipment repair, changes in equipment size, or re-design of control algorithms.

## Implement Solutions (Optimization)

Once the solution is defined, it must be implemented. For simple fixes, such as controller tuning changes, this can happen fairly quickly.

Active Model Capture Technology & Performance Supervision

Active Model Capture Technology can reduce the Problem-solving time dramatically, because the first 6 steps of problem-solving are automated. The problem-solving personnel (process engineer, etc.) are only involved AFTER the problem has been identified, analyzed, and prioritized.

Active Model Capture Technology works by monitoring the process continuously, 24 hours a day. It looks at process changes created by setpoint changes, mode changes, and disturbances to develop a dynamic model of process behavior. This model includes a wide variety of fundamental and performance-based parameters. For example, it will capture models for:

- Dynamic Process Model

- variability

- controller performance

- measurement noise

- oscillation

- valve performance.
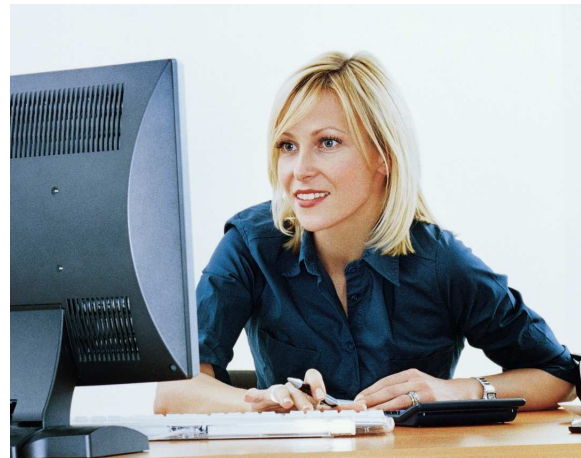
The model is then validated and recorded. Model parameters are then compared against historic baseline conditions. If a significant change has occurred, or if the model has drifted from normal range, then a problem is identified.

The preliminary data analysis have been completed automatically. By feeding the model into a Performance Supervision System, Detailed Data Analysis and Prioritization are also completed automatically. Because the Performance Supervision System is assessing many aspects of process performance, the detailed analysis will be much more complete than that done by an individual person solving a problem.

Some Performance Supervision Systems have the ability to rank performance assessments using a combination of severity and economic importance. The results of the ranking are displayed graphically, and the problem-solver knows immediately where to focus attention.

Many types of recurring plant problems are easily identified, prioritized, and reported with Active Model Capture Technology. For example, heat exchanger fouling, pump failures, and control valve hysteresis or stiction can all be found with almost no effort on the part of the problem-solver. An automated report or e-mail alert can be sent directly to the maintenance planner.

Similarly, opportunities for process improvement can be rapidly identified, within days of using Active Model Capture Technology. Standard templates for performance can be applied, and generate "trouble spots" within hours. For example, a standard template for Flow Control Loops identifies if process dynamics or variability are outside of the normal

range for Flow Loops. If an important flow loop, such as feedwater flow to a boiler, is out of normal range, it is immediately flagged as a loop needing attention.

## Case Studies & Benefits

No Bumps Required

Active Model Capture Technology gathers data from normal process operation. It takes advantage of any normally-occurring changes, such as setpoint changes, mode changes, and other operator actions. In this way, it is very opportunistic in gathering the data that is needed. A sophisticated set of rules define data can be used for each type of performance assessment.

Start Fixing Problems Immediately

Because Active Model Capture Technology is working all the time, it will find and report problems without any pre-work. In fact, you don't even need to know that you have a problem! By simply viewing the problems ranked in order of economic importance, the problem-solver can deliver results right away.

Find Hidden and Intermittent Problems

Intermittent problems can be some of the toughest problems to find. They may create a problem downstream, and then hide from view for hours or even days before recurring. In case 1, below, an intermittent failure of a pump seal was identified, flagged, and reported. Without Active Model Capture, the user might never have known of this problem until it came back and shut down the plant.
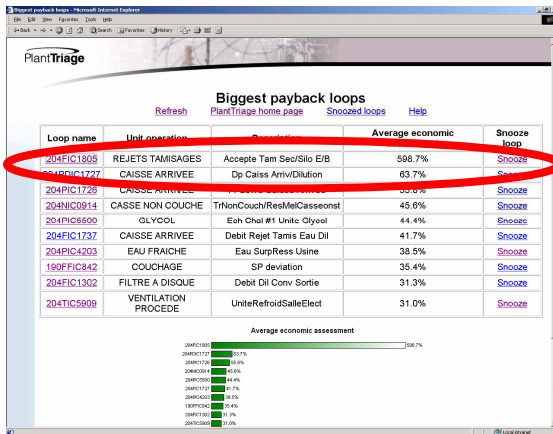
Case 1: Pump Problem Identified, Prioritized:

The system reports that the captured model is significantly worse than acceptable range. This problem has been identified, prioritized, and is reported directly to the user without any intervention on the part of the problem-solver.
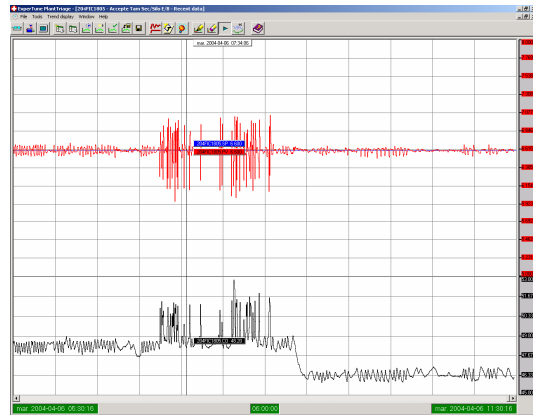
Case 1: Detailed Analysis:

The data for analysis was already in place, and readily showed a problem with the pump.

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Controller Tuning Instantly

Case 2: Model Captured

In this case, a control engineer wanted to tune all of the control loops in a unit operation. The process deadtime, process gain, and lags have been captured automatically using Active Model Capture Technology. These results are shown at left

Case 2: Controller Tuning

Because Active Model Capture Technology has already captured the dynamic process model, controller tuning can take place immediately, with no process intervention. The control engineer or maintenance personnel performing the tuning can review the model, accept the proposed tuning, and simulate the results directly from their desktop. After communicating the change to operations, the new tuning can also be downloaded directly from the desktop.
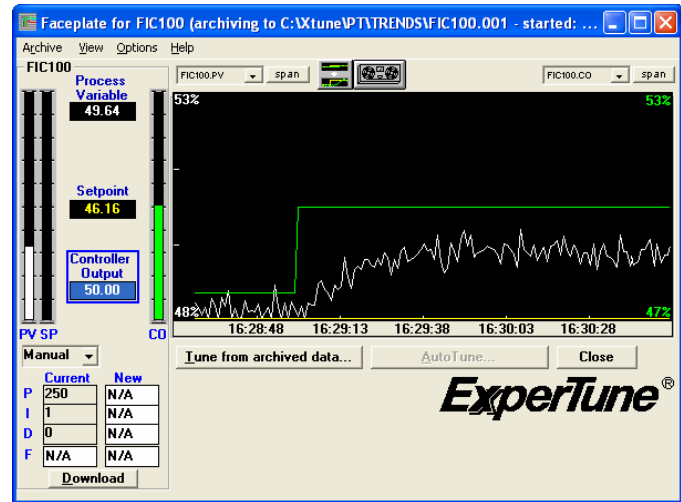
Compared to the traditional approach to tuning, this is a vast reduction in the effort required to tune a control loop.

Conclusions

.Active Model Capture Technology dramatically reduces the effort required to solve problems and improve the performance of the process. Because data is gathered, models are calculated, and results are prioritized automatically, the problem-solver can focus on **solving** problems, rather than spending unnecessary time in the investigation.

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For more information about Active Model Capture Technology, or to discuss any of the content of this white paper, please contact George Buckbee, Director of Product Development at ExperTune, Inc. at (262)369-7711 or email sales@expertune.com .

About the Author

George Buckbee, P.E. is Director of Product Development at ExperTune, Inc. George holds a B.S. and M.S. in Chemical Engineering, and has over 20 years of direct applications experience in the Process Control field. George is responsible for development of ExperTune's PlantTriage Performance Supervision System and PID Tuner/Analyzer.