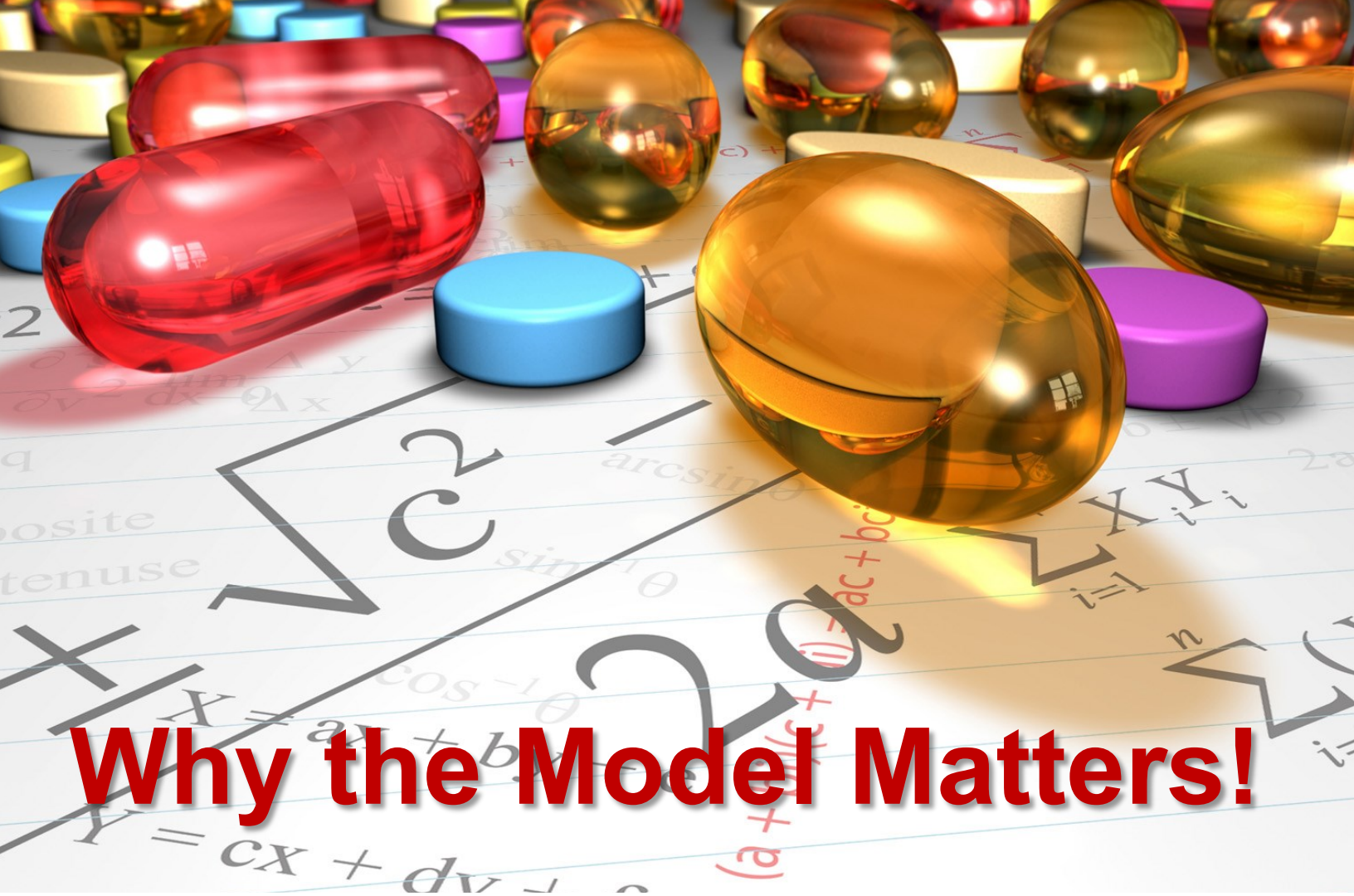


Why the Model Matters!

Accurate Modeling of Highly Dynamic Industrial Processes is the Key to Improving Production Efficiency and Throughput

When a control loop can be maintained at a steady-state before performing a step test, it is relatively easy to tune manually. It's when process conditions are complex that practitioners need the help of software. Historically that's when software has failed — and failed consistently. But something has changed in the modeling of 'real world' processes.

control station

Optimization Solutions for Controller Performance and Asset Reliability

Why the Model Matters!

PID has been the workhorse of process control for as long as most engineers can remember. In the simplest sense PID functions based on an understanding of a process' dynamics. A process model comprised of three parameters — *Gain, Time Constant, and Dead-Time* — provides that understanding. Undeniably the model's accuracy is essential to achieving effective control as it's the model that drives a given PID's tuning parameters. So, if the underlying model is so critical to achieving safe, profitable operation, then why isn't good modeling given greater emphasis?

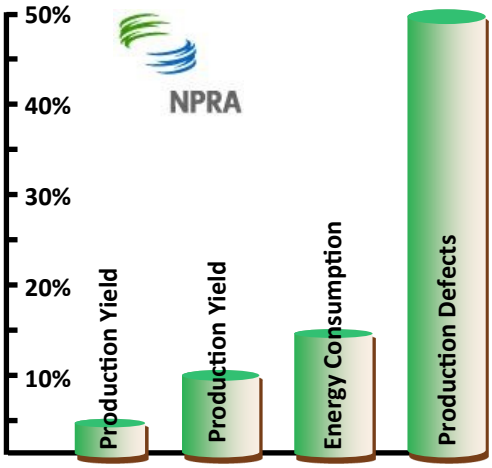
Process modeling and PID controller tuning software was originally introduced to help practitioners cope with the complexities of oscillatory, noisy processes. For decades the state-of-the-art for such software required users to establish a steady-state condition before introducing a controlled change. The change, or step test, revealed the cause-and-effect relationship between the Controller Output and Process Variable, and it allowed the software to approximate the corresponding model parameters. Unfortunately without a steady-state condition the software would either reject the data or generate a flawed model. The irony is that when a control loop can be maintained at a steady-state before introducing a controlled change it is relatively easy to tune manually. Practitioners turned to software for help with their difficult loops, but traditional software only worked when those loops were just as easily tuned by hand.

From a historical perspective, the answer to the question about modeling's importance was simply borne of bad experience. If truly state-of-the-art technology delivered results that were marginal at best, then there would be little to no value in emphasizing its use. If such software products could only handle the simplest of tasks, then it would be counterintuitive to invest in them. What's more, practitioners would be justified in their application of traditional, manual approaches to process modeling and controller tuning. That would be reasonable. Limited capabilities led practitioners away from software and for good reason.

So what if things have changed in the way software models highly dynamic process data? What if oscillatory, noisy processes – *what we refer to as the 'real world'* – were no longer a challenge? What if technology could easily handle integrating and non-integrating processes? What if models could be generated on a real-time basis using the data from everyday output changes? For sure the economic benefits of well-tuned PIDs are documented. That's why the model matters.

Non-Steady State Modeling for Real-World Applications

Process modeling technology has evolved in a meaningful way. In 2008 the first commercial-off-the-shelf software capable of accurately modeling oscillatory and noisy process data was introduced. The software's patent-pending approach to data modeling discarded over forty years of conventional wisdom. It applied a novel approach for describing the dynamic relationship that exists between a control loop's Controller Output and its Process Variable — the basis for any process modeling software. More importantly the approach eliminated the need for a steady-state condition at either the start or the end of dynamic testing. The NSS Modeling Innovation as it's called broke a mold that had previously constrained the efficacy of PID controller tuning software. It enabled practitioners to accurately model and tune PID controllers at start-up, during cut-over, and in virtually every complex commercial application. Now that's the real world.



NPRA documented the economic benefits associated with regular PID controller tuning.

Modeling a Full Range of Applications

The true value of the NSS Modeling Innovation stems from its effectiveness when applied to any type of industrial production process and at any phase of production. Various software products lay claim to the ability to model non-steady state process data. Unfortunately those tools are limited to use with integrating processes such as Level. Even though such a capability offers meaningful improvement relative to others, its value is nonetheless limited as only an estimated 10-15% of industrial processes possess integrating characteristics.

True non-steady state modeling and tuning software can accurately describe the dynamics of both integrating and non-integrating processes. It can model oscillatory and noisy data whether captured in open-loop or closed-loop. Through these capabilities the NSS Modeling Innovation is thus restoring the practitioner community's confidence in PID controller tuning software. It is empowering them to quickly and consistently resolve complex control loop performance issues – the type of issues for which software was always needed.

Optimizing Plant-Wide PID Control Loop Performance

Process optimization has become an increasingly lofty goal for many manufacturers. From the start of 2008 thru September of 2012 the US Bureau of Labor Statistics documented a loss of 1.77 million jobs specifically from the manufacturing sector. That number represents nearly 13% of the domestic workforce. With fewer resources on hand process manufacturers have been forced to prioritize engineering and maintenance tasks. The need to sustain operation has widely eclipsed the desire to optimize it. However, plant-wide monitoring tools that leverage the NSS Modeling Innovation are now empowering some manufacturers to achieve significant performance gains with minimal investment.

When utilized in the context of a monitoring and optimization application the NSS Modeling Innovation isolates each change in Controller Output and automatically generates a current model of the process. In a typical production facility such output changes occur dozens of times each day, and they provide the basis for continuous process improvement. As with PID tuning software, however, other tools that actively model process data remain limited in their use. Unlike their counterparts powered by the NSS Modeling Innovation, these products lacked the ability to generate accurate models of oscillatory and noisy data.

Plant-wide control loop performance monitoring tools leverage the NSS Modeling Innovation to generate accurate models of each output change, providing opportunities to optimize loop performance without performing a step test.

Improving Production Efficiency and Throughput

A growing portfolio of process modeling technologies are available to support the needs of process manufacturers. They leverage the NSS Modeling Innovation and are free of the steady-state constraint. As such, they offer a new vehicle for realizing improvements in both production efficiency and throughput.

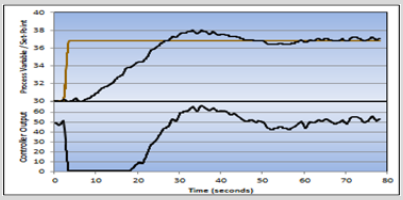
When pursuing optimal PID control, the model truly matters.

Putting the NSS Modeling Innovation to the Test

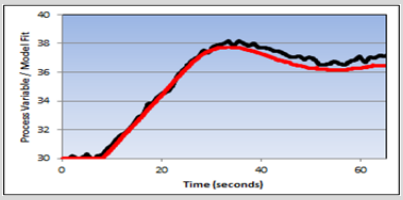
The NSS Modeling Innovation has been put through rigorous testing, including side-by-side comparisons with other leading PID controller tuning packages. The results have been consistent. What's more, they've been eye opening. Below are the results.

Test #1: Simple Bump

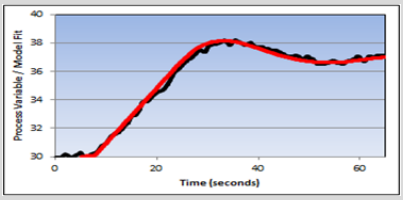
Step Test



Model Fit: Other



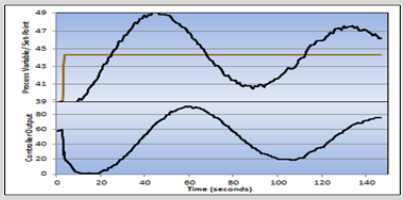
Model Fit: NSS Modeling Innovation



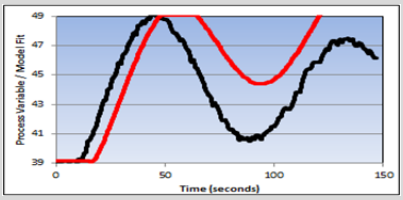
Performed a simple step test to an integrating process – both beginning and ending at steady-state condition. As the graphic on the left shows the Set Point was adjusted by 7% . As may have been expected both the Other and NSS Modeling Innovation produced comparable models that accurately describe the process' dynamics.

Test #2: Single Step Up

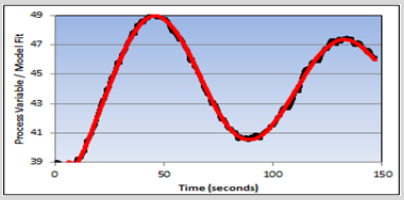
Step Test



Model Fit: Other



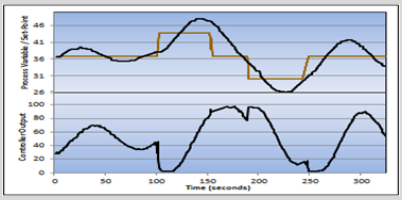
Model Fit: NSS Modeling Innovation



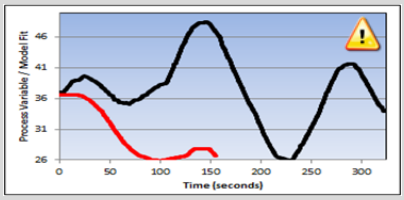
Performed a simple step up of 7% to the same integrating process as shown on the left. The process began at steady-state prior to the test but it ended in a transitional state. The Other incorrectly fit a non-integrating model to the process data and supplied no warning. The NSS Modeling Innovation supplied a warning that integrating characteristics were identified in the process data and fit the appropriate model.

Test #3: Complex Test

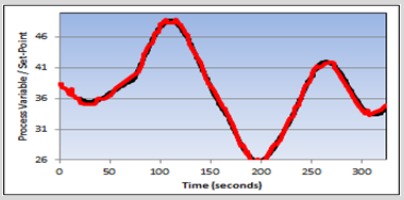
Step Test



Model Fit: Other



Model Fit: NSS Modeling Innovation



Performed a doublet test to the same integrating process – equal 7% bumps above and below Set Point. The Other incorrectly calculated the controller action. A warning message was presented that reinforced Other's requirement for steady-state operation prior to performing tests. The NSS Modeling Innovation fit a model that accurately described the process' dynamic integrating characteristics.

LOOP-PRO™: Software Powered by the NSS Modeling Innovation

Control Station's LOOP-PRO Product Suite is comprised of award-winning, industrial grade process modeling and PID controller tuning software tools. Control Station is proud to have its products either private-labeled or referenced by industry-leading OEMs such as Rockwell Automation, Yokogawa Corporation of America, and NovaTech Process Solutions — formerly Texas Instruments. Each of its products is powered by the NSS Modeling Innovation and equips practitioners to tackle the complexities of highly dynamic industrial control loops.

If you experience difficulty modeling and tuning oscillatory and noisy PID control loops, contact Control Station and learn how LOOP-PRO and the NSS Modeling Innovation can help you tackle your industrial strength challenges.

LOOP-PRO 5

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