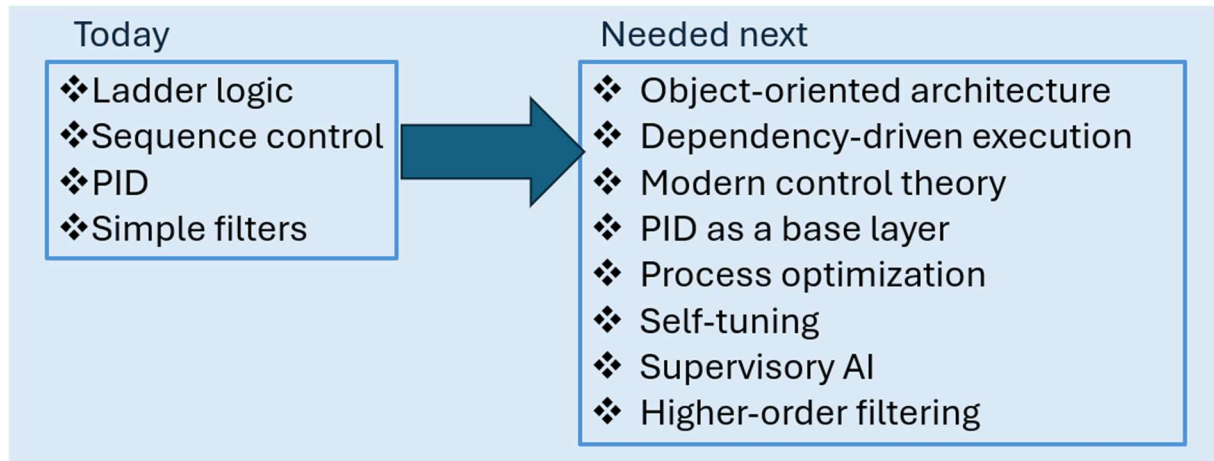


A Paradigm Shift Is Needed in Automation

By

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I have worked with installations in complex industrial processes for more than 30 years, and I am surprised that automation is still, to a large extent, designed according to the same basic principles as in the 1990s. This is also an important reason why many people in industry find that the improvements they expected fail to materialize when older systems are replaced by new ones, since control methods developed more than 50 years ago are still being used.

Universities and technical colleges also play a role in this development. Practical teaching in control engineering often consists of explaining how to use a PID controller in an Allen-Bradley or Siemens system, something that suppliers themselves should be handling. Since I resumed cooperation with the academic world, I have also been surprised by research reports describing how PID should be used to optimize a process, while completely ignoring the powerful methods available in modern control theory.

From the very beginning, First Control has focused on using more intelligent control methods, including self-tuning controllers. I can therefore say with great confidence that accuracy can be improved by 50–75 percent and yield in complex processes by 5–10 percent. In addition, the process becomes more stable and requires significantly less maintenance.

Almost all industrial control systems today are created using PLC/ICS systems and programmed by engineers who depend on the control methods made available by those systems. These are therefore the systems that must change.

Our own contribution, XC05Edge, is a step in this direction. See

<https://www.firstcontrol.se/>

1. Today's PLC/ICS systems are still built on outdated architectural and programming principles

Many PLC/ICS systems are still fundamentally based on ladder diagrams, sequence machines, and instruction-based programming methods, even if they are now often presented in a more graphical form. These methods have worked well for simpler control and logic, but they are inadequate for today's more complex processes.

The problem is not that these methods have no value at all. The problem is that they have become the norm even where the application actually requires something more advanced. The result is that processes are automated, but not improved to the extent that is possible.

The future of automation therefore requires a different structure: object-oriented architecture, multitasking, and reusable function modules in compiled code. Engineers should be able to build advanced applications graphically and safely, without having to resolve every complex dependency and interconnection in detail themselves. The system should help them do that.

When basic functions such as controllers, filters, communication, and supervisory control functions are built as robust objects in internal libraries, they can be reused across projects. This provides higher reliability, lower engineering cost, and better continuity during system upgrades

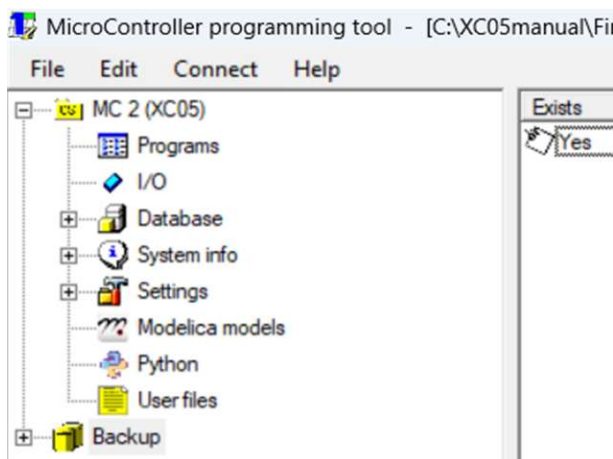


Fig. 1

In XC05Edge, the user is guided through all programming and configuration by a graphical tool.

2. Real process improvement requires more than PID and simple filters

PID controllers and simple signal filters have an obvious place in industry. They are robust, well known, and often very useful. But they are not enough to drive real process improvement very far in more demanding applications.

It is therefore not surprising that many people feel that control performance does not improve as much as they had hoped. If control still relies mainly on the same principles as in the analog era, the result will also remain limited.

Complex processes require modern control methods: model-based methods, predictors, adaptive controllers, optimizing functions, and more advanced signal processing than simple first-order filters. Only when these methods are made practically usable in everyday engineering can automation take a real step forward.

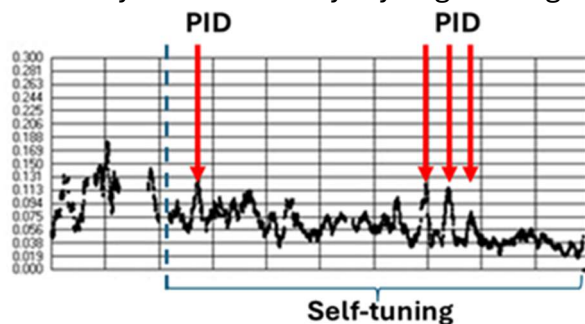


Fig. 2

In a continuous caster, the frequency of large mold-level disturbances dropped by 75% with the STREGX2 adaptive controller.

Read more about adaptive control in industrial practice

<https://www.firstcontrol.se/wp-content/uploads/2026/02/Self-tuning-as-automation-standard.pdf>

3. Self-tuning should be used more broadly in automation

Self-tuning is often associated mainly with adaptive control, but its potential is greater than that. Almost all modern control theory is based on a dynamic process model used to calculate, in some sense, an optimal control strategy. The problem is that such

models are rarely available and are often costly to develop. Even when a model does exist, it has difficulty describing all the situations that arise in an industrial process.

One solution is the so-called self-tuning concept, in which a general high-order linear model is created during operation using some form of recursive identification method. Based on this model, which is entirely data-driven, the control strategy is then calculated using the chosen method.

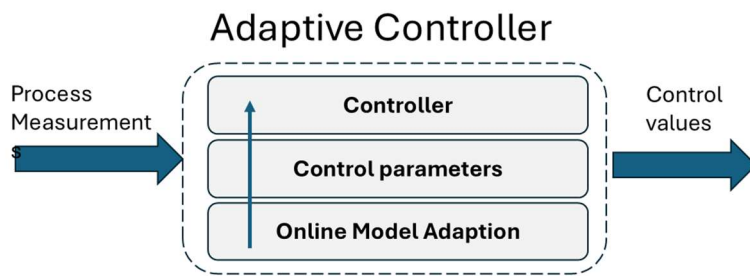


Fig. 3

A high-order dynamic model is identified online using a forgetting factor.

This can be used in control functions, but also in other functions within automation. We have used the technique in:

- adaptive controllers to improve control accuracy
- adaptive neural networks to optimize production changeovers
- adaptive extremum-seeking controllers for online optimization of measurable process variables
- adaptive predictors to predict future values

We have been able to do this using only a model created from real-time process data. Another important point is that these control strategies automatically adapt to changes in process dynamics, which greatly reduces maintenance requirements.

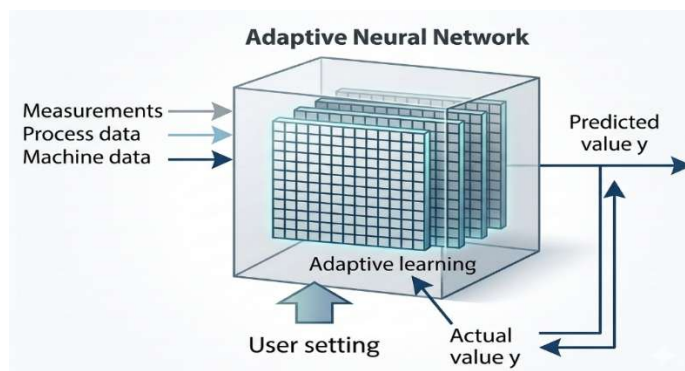


Fig. 4

We have used self-tuning neural networks to optimize production changeovers in a Zinc coating line and a Kaplan turbine.

Read more about the self-tuning neural network

<https://www.firstcontrol.se/wp-content/uploads/2026/03/Selftuning-AI.pdf>

4. AI is powerful, but it must be used in the right way

AI is a very powerful technology, but it must be used in the right way in automation. AI is a broad term covering a number of powerful methods suited to different kinds of problems. It cannot replace modern control engineering, but it can complement it very effectively.

AI is particularly well suited for a supervisory layer responsible for analysis, optimization, pattern recognition, decision support, and the handling of complex relationships that lie above direct real-time control. In that role, AI can provide major benefits.

5. The supplier must take responsibility for robustness and usability

A key reason why modern control methods have not achieved wider industrial adoption is that they have often not been made sufficiently accessible to the engineers who actually build and maintain these systems.

It is not enough for the methods to exist in theory or in research papers. They must be made available in standard PLC/ICS systems in a form that works in practice. The supplier must take responsibility for two things at the same time: robustness in real operation and usability for the engineer.

Engineers should not have to be specialists in advanced control theory in order to use modern methods. Just as PID once became widely usable through standardization and practical interfaces, modern control methods, self-tuning, and AI-based support functions must also be made available as robust and usable standard objects.

Only then can these methods achieve the broad industrial adoption they deserve.

Conclusion

A paradigm shift in automation is not only about introducing new technology. It is about leaving outdated architectural and programming principles behind, making modern control methods practically usable, and using AI in the right role.

Today's PLC/ICS systems automate the process, but do not improve it sufficiently. To reach the next step, object-oriented architecture, reusable and robust function libraries, modern control methods in standardized form, and AI as a supervisory complement are required, designed so that they can be used by process engineers in their daily work without specialist expertise.

Many processes operates suboptimal today. By improving the intelligence in the control system there is a big potential for process improvements, both in stability and performance.