Faster and Less Expensive APC Implementations

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Overview

- APC - What's all the fuss about?
- Why do I need it?
- Traditional implementation approach
- Opportunities for change
  - Pre-testing
  - Multi-variable step testing
  - Closed loop step testing
  - Modeling
- Protecting your investment

APC – What's all the fuss about?

- Originally, APC was broadly thought of as anything more complicated than a PID controller.
- Most people think of Model Predictive Control (MPC) is analogous to APC
- Really a generic term for a range of control theory and techniques such as Fuzzy Logic, Statistical Process Control (SPC), MPC, etc.
- APC techniques have been designed to emulate Operators
- You already have APC on your payroll

Why Do I Need It?

- Operators vary in knowledge and experience
- Operators have multiple responsibilities
- Operators retire or leave to work for your competitors
- Human brains are not designed to be analytical calculation engines
- How many handles can an Operator realistically pull?

Traditional Approach

- Understand process and operations
- Define opportunities for APC
- Pre step testing – Identify existing process or process control issues
- Perform remediation work
- Perform step testing to produce data for process modeling
- Develop process models
- Build controller using process models
- Test controller performance against a simulated plant
- Integrate APC controller with the existing control system.
- Commission APC controller by choosing appropriate tuning weights and correcting models where appropriate
- Perform further step testing if inadequate models are found

Opportunities for Change

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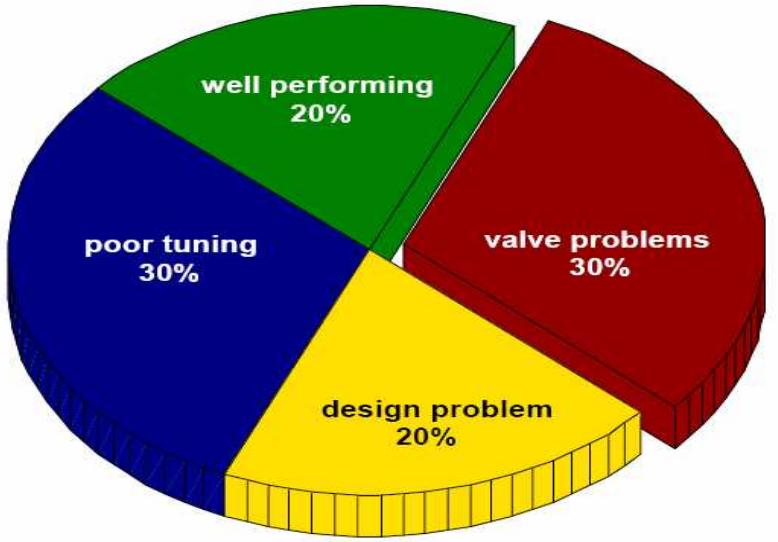
Pre-testing

- Time typically spend performing initial step testing on process variables
- Produces limited data for analysis
- Alternative is to use Control Performance Monitoring (CPM)
  - Non intrusive
  - More data available
  - Builds a picture of the entire plant's controller performance

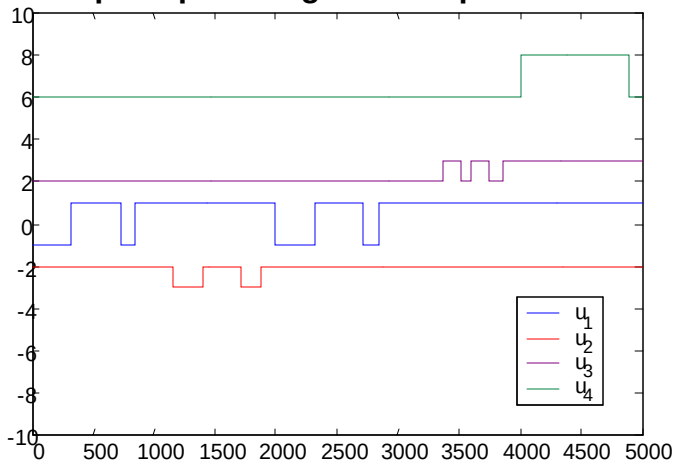


(Bialkowski, 1992)

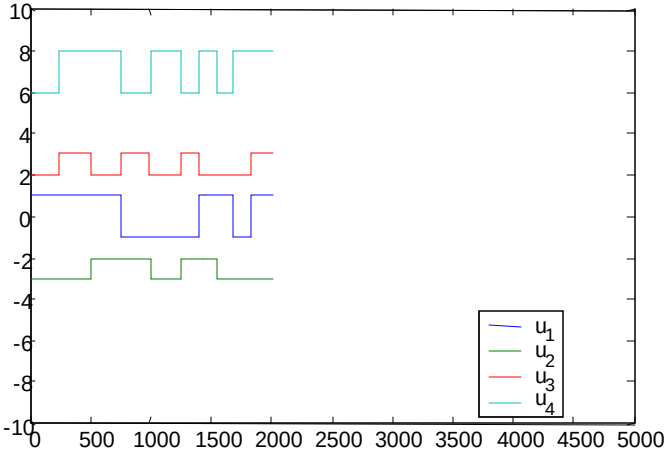
Multi-variable Step Testing

- Total step test time is no longer dependent on number variables
- Step changes are uncorrelated so that a cause/effect can still be observed
- More steps can be made and more data collect over the same period of time
- Can use traditional modeling tools to produce models

Sample input design: One Input at a time



Input Design: Moving more than one input at a time



Closed Loop Step Testing

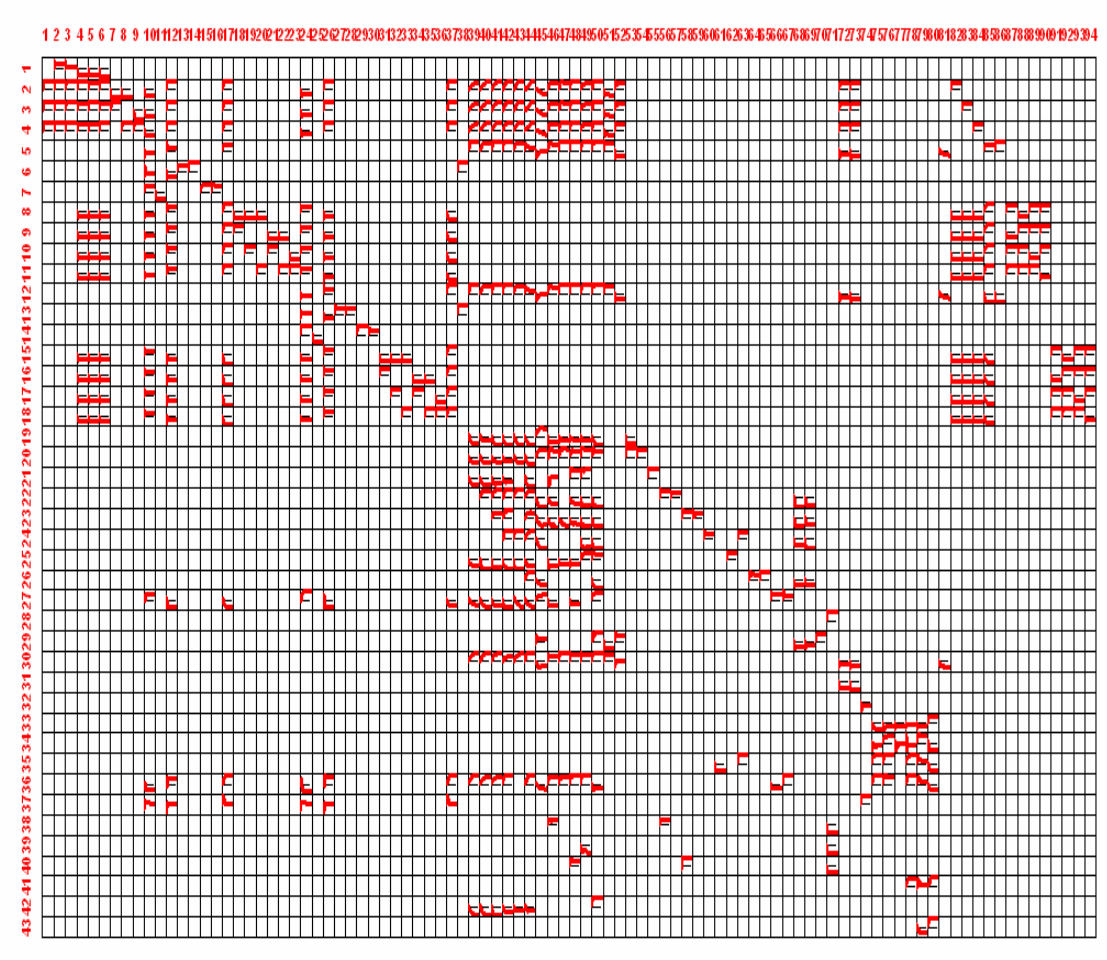
- Open-Loop step testing models the process only
- Closed-Loop step testing models the process and the controller behavior
- APC controllers require the process behavior only to be modeled
- Need a special closed-loop identification algorithm – TaiJi
- Enables operator to keep one or more controllers in service – be it a PID loop or an existing APC application

Modeling

- Modeling is typically performed off-site using data obtained during step testing
- Modeling may identify insufficient or poor quality step test data
- Re-step testing can be expensive and frustrating
- Advantage in performing modeling during step testing
- Provides feedback on the quality of the models
- Step testing can be modified to improve model quality

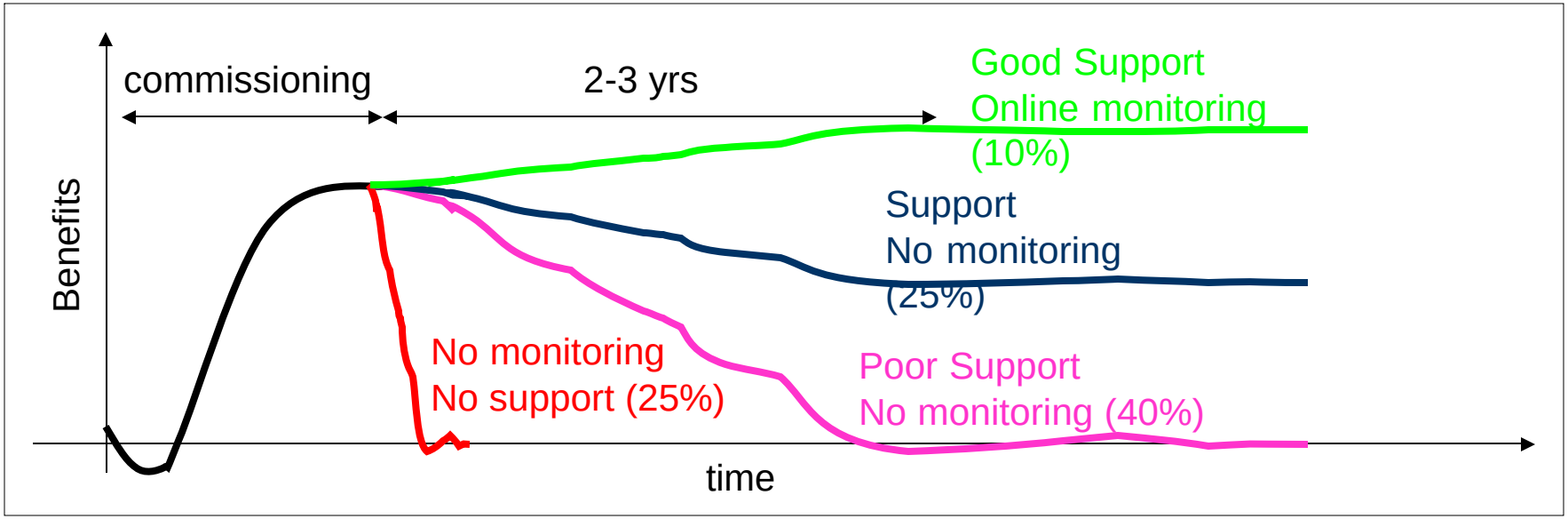
Case Study

- 43 x 94 Model Matrix
- Similar unit took 2 months to step test and model using traditional approach
- 2 months of consultants time, potentially unsafe operation, engineering time and lost benefits!
- With new paradigm, the total time to step test and model was ~7 days



Protecting your Investment

APC Scenario: **In many plants today, controllers "run to failure"**



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