What’s New in APC
V8 – January 2013

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Altaf Khan, Principal Business Consultant
What’s New?
Plenty!

APC Builder
Complete re-design of the DMCplus Model Builder

Adaptive Process Control
Continuous process for maintaining APC models
Linear Dynamic Modeling

Step Test Data

Historical Data

Process Knowledge

Linear Dynamic Models
Historical Review of Model Identification

1980’s:
• Command line tools

1990’s:
• Windows

2000’s:
• Improved testing – SmartStep
• Improved algorithms – Subspace, SmartAudit

2010’s:
• Improved workflow
• Constrained identification
• Embed structure
Identification Workflow

Data Management
- Collection
- Preparation: Slicing

Case Management
- Linearization Transforms
- Trial Creation
- Deadtime Specification
- Structure Specification

Model Creation
- Assembly
- Conditioning
Identification Workflow

From the previous workflow:

DMCplus Model → Frequency Analysis → Correlation Analysis → Smart Audit

To the new workflow:

APC Builder
APC Builder

Increase Self-Sufficiency

Improve Practitioner Efficiency

Leverage Process Knowledge
APC Builder

Increase Self-Sufficiency

All case management tools in one place

Automatic Dead Time calculations

Improved gain repair algorithm
APC Builder

Increase Self-Sufficiency

Co-linearity analysis
Automatic data slicing
Model convolution
Integrated prediction error
Piecewise transforms

Leverage Process Knowledge
Increase Self-Sufficiency

Impose known process characteristics on model identification to improve model fidelity
- Dead time
- Dynamics
- Gains

Leverage Process Knowledge

Improve Practitioner Efficiency
APC Model Builder Demo
Adaptive Process Control
A New Approach
Adaptive Process Control

“Don’t build yet another tool for sustained value; instead, build a controller that needs less maintenance”
Adaptive has several advantages over traditional sustained value approaches

- The controller model is continually analyzed for accuracy
- Poorly performing areas of the model are identified
- Non-disruptive background testing collects new process data
- New data are monitored in real time and bad data are automatically identified and removed
- New candidate models are automatically created and presented to the engineer for review

Automated Test Agent monitors the entire process in real time
Adaptive Process Control

Optimizing Control During Testing

Precision Re-vamps

Process vs. Projects
Situation: Controller Off During Testing

- First-generation maintenance tools delivered benefits, but didn’t solve the biggest cost issues
  - Shorter cycles, but more disruptive
  - Lost capacity
  - Reduced quality
  - Testing required constant management

- Controller turned off to collect open loop data
Revamping a controller often required up to 80% of the original effort (and cost!)

- Latent (and not-so-latent) costs of plant step testing
- Lack of precision in identifying problem areas of the models
- Co-linearity detection and repair were not integrated with the other modeling workflows
- Preparing data for Model Identification was manually intensive
- Generating candidate models required a lot of activity by the control engineer
APC Maintenance methodology mirrored the initial project. That produced undesirable side effects

- Maintenance is commonly deferred until unit turnarounds and in the interim, controller performance becomes untenable
- Degrading performance oftentimes results in operators turning off the controller
Adaptive Process Control

- The Concept
  - Do everything required to update the models without the need to turn off the controller.
  - Ensure that the controller exhibits robust behavior during the periods between model updates.
  - Make maintenance a built-in and continuous part of the process and eliminate the need to wait for turnarounds to revamp controllers.
  - Incorporate knowledge of control within the products and leave it to the users to leverage their in-depth knowledge of the production process.
Innovations

Adaptive Process Control

| Model Quality Analysis | Robust Control w/ Economic Relaxation | Closed-loop Capable Model ID | Automatic Data Slicing | Adaptive Modeling |

Automatic generation of candidate models. Assessment tools for rapid evaluation of fidelity.
Adaptive Process Control

Test Agent

- Problem: Need the ability to monitor plant step tests and model identification to catch problems that can disrupt the adaptive process.

- Solution: Test Agent
  - Real time evaluation of step test data quality
  - Real time model identification progress report
  - Guided workflow for Adaptive Modeling
Test Agent

- Test Agent can detect problems in a timely fashion
  - Is the test data being collected and stored?
  - Are the associated PID loops working properly?
  - Is the instrumentation reading reasonable values?
  - Are there any unmeasured disturbance affecting the process?
  - Is the Tester (Adaptive Mode) making sensible moves yielding adequate signal to noise ratio?

- Special considerations in software design
  - Site operators/engineers already have tons of things to monitor
  - Test Agent uses
    - Priority based alarm
    - Drill down trouble-shooting capability
    - Guided workflow
Adaptive Process Control Demo
Adaptive Process Control

- Moves controller maintenance from a project methodology to a continuous work process.
- Eliminates many of the tasks requiring control engineering resources.
- Maintains APC benefits without extended periods where performance degradation has to be tolerated.
- Exhibits robust controller behavior during periods of model calibration.
- Engineer is always in the loop regarding model acceptance and deployment.
Adaptive Process Control
Benefits

**Continuous Improvement**
Eliminates poor controller performance cycles while waiting to revamp controllers

**Reduced Product Giveaway**
Smaller perturbations during testing are less disruptive and costly

**Reduced Supervision**
Background step testing reduces impact on the plant
aspentech

Put Everything You need Right at Your Fingertips.

Building on a generation of APC knowledge and experience, we've streamlined workflow and features to deliver unprecedented ease of use and efficiency for building APC applications.

Make APC Maintenance a Process Instead of a Project.

Adaptive Process Control eliminates the need to approach APC maintenance as a project and creates a continuous process of assessing model quality, collecting current process data, and generating new models as the behavior of the plant changes over time.

Visit www.aspentech.com to learn more.
## APC Online hardware requirements

The following hardware requirements must be met when installing any Online product.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Minimum Requirements</th>
<th>Recommended Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Platform</strong></td>
<td>Windows Server 2008 R2 Standard Edition (64-bit), IE 7</td>
<td>Windows Server 2008 R2 Standard Edition (64-bit), IE 8 or IE 9</td>
</tr>
<tr>
<td><strong>Processor</strong></td>
<td>Dual-core 2.5 GHz</td>
<td>Quad processor, 3 GHz or faster</td>
</tr>
<tr>
<td><strong>Physical Memory</strong></td>
<td>2 GB (see note below)</td>
<td>6 GB (see note below)</td>
</tr>
<tr>
<td><strong>Hard Disk Space</strong></td>
<td>2 GB free (see note)</td>
<td>2 GB free (see note)</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>1024x768</td>
<td>1280x1024</td>
</tr>
</tbody>
</table>

**Note:** Memory requirements are highly dependent on the number and type of applications. Additional disk space may be required for larger applications and data sets. The numbers listed above are guidelines.
## Hardware Requirements

### Web server hardware requirements: 1 to 5 users

<table>
<thead>
<tr>
<th>Resource</th>
<th>Minimum Requirements (1-5 users)</th>
<th>Recommended Requirements (1-5 users)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platform</td>
<td>Windows Server 2008 R2 Standard Edition (64-bit) and IE 7</td>
<td>Windows Server 2008 R2 Standard Edition (64-bit) and IE 8 or IE 9</td>
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<tr>
<td>Processor</td>
<td>Dual-core 2.5 GHz</td>
<td>Quad processor, 3 GHz or faster</td>
</tr>
<tr>
<td>Physical Memory</td>
<td>2 GB</td>
<td>6 GB</td>
</tr>
<tr>
<td>Hard Disk Space</td>
<td>1 GB</td>
<td>2 GB</td>
</tr>
<tr>
<td>Display</td>
<td>1024x768</td>
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</tr>
</tbody>
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### Web server hardware requirements: 6 to 30 users

<table>
<thead>
<tr>
<th>Resource</th>
<th>Minimum Requirements (6-10 users)</th>
<th>Recommended Requirements (10-30 users)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platform</td>
<td>Windows Server 2008 R2 Standard Edition (64-bit) and IE 7</td>
<td>Windows Server 2008 R2 Standard Edition (64-bit) and IE 8 or IE 9</td>
</tr>
<tr>
<td>Processor</td>
<td>Dual processor, 3 GHz</td>
<td>Quad processor, 3 GHz or faster</td>
</tr>
<tr>
<td>Physical Memory</td>
<td>4 GB</td>
<td>16 GB</td>
</tr>
<tr>
<td>Hard Disk Space</td>
<td>4 GB</td>
<td>4 GB</td>
</tr>
<tr>
<td>Display</td>
<td>1024x768</td>
<td>1280x1024</td>
</tr>
</tbody>
</table>
## APC Performance Monitor hardware requirements

The following hardware requirements must be met when installing Aspen Watch Performance Monitor Server or Aspen RTO Watch Performance Monitor Server.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Minimum Requirements (6-10 monitored applications)</th>
<th>Recommended Requirements (10-30 monitored applications)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Platform</strong></td>
<td>Windows Server 2008 R2 Standard Edition (64-bit) and IE 7</td>
<td>Windows Server 2008 R2 Standard Edition (64-bit) and IE 8 or IE 9</td>
</tr>
<tr>
<td><strong>Processor</strong></td>
<td>Dual processor, 2.5 GHz</td>
<td>Quad processor, 3 GHz or faster</td>
</tr>
<tr>
<td><strong>Physical Memory</strong></td>
<td>4 GB</td>
<td>16 GB</td>
</tr>
<tr>
<td><strong>Hard Disk Space</strong></td>
<td>7200 RPM or higher speed drive required. For calculating actual hard disk space required, see the WatchDiskSizeCalc.xls file, available from AspenTech Support or, after installation, from the Tools folder.</td>
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Hardware Requirements – Go Virtual!

- 8-16 core machine
- 32GB RAM
- Run 2-3 virtual machines and distribute the CPU and memory load as needed
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Non-Linear Control and Transition Management on a Spheripol Process

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