Our speakers

WEBINAR SERIES FOR MENA, PART 2

Featured speakers
Sam van der Zwan, expert pipeline hydraulics
Mina Ibrahim, hydraulic surge protection lead engineer

Digital twins for pipeline systems

December 16 – 1:00 pm UAE, 10:00 am Delft
Webinar topics

1. Big corporation pipelines Hydraulics
2. The Imitations of existing Monitoring system
3. Automated Expert Monitoring (Digital Twin)
4. Example of AEM
Big corporation pipelines Hydraulics
The Imitations of existing Monitoring system

Each organization has big collected data via SCADA system
The Imitations of existing Monitoring system

Experts are needed to analyze the data interpreting it into useful information

For big organization It is a costly and time-consuming
The Imitations of existing Monitoring system

The Automation is the best solution when we have big scale of work and limited resources such as the experts.
The Imitations of existing Monitoring system

Existing Monitoring system
Why Benchmark!

1. Pumps performance compare operation of different pumps

Two identical pumps in one pumping station operating on different PI
Why Benchmark!

2. Operation

Complicated systems needs more than manual calculated indications
Why Benchmark!

3. Control Valves

4. NRV Valves

NRV Received Data during design

<table>
<thead>
<tr>
<th>D</th>
<th>0.4 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>0.722923 (-)</td>
</tr>
<tr>
<td>Rminor</td>
<td>2.333315 (m3/s)^2/m</td>
</tr>
<tr>
<td>Kv</td>
<td>7525.952 (m3/hr)/1bar</td>
</tr>
<tr>
<td>Cv</td>
<td>8700 (GPM)/1PSI</td>
</tr>
</tbody>
</table>

The actual value which includes closing assisting springs and counterweight k=6.36 circa, 10 times the resistance!

<table>
<thead>
<tr>
<th>D</th>
<th>0.4 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>6.36 (-)</td>
</tr>
<tr>
<td>Rminor</td>
<td>20.52761 (m3/s)^2/m</td>
</tr>
<tr>
<td>Kv</td>
<td>2537.342 (m3/hr)/1bar</td>
</tr>
<tr>
<td>Cv</td>
<td>2933.167 (GPM)/1PSI</td>
</tr>
</tbody>
</table>

Cavitation Check based on valve manufacturer data Additional benefit power loss need to be checked

<table>
<thead>
<tr>
<th>Flow CMH</th>
<th>Head loss (m)</th>
<th>MW/Year</th>
<th>AED/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>50.00</td>
<td>765.101</td>
<td>913.26</td>
</tr>
<tr>
<td>Max Flow</td>
<td>600.12</td>
<td>636.821</td>
<td>9,122.76</td>
</tr>
<tr>
<td>Avg</td>
<td>5,018.01</td>
<td>903,241.44</td>
<td></td>
</tr>
</tbody>
</table>

IHE Material for small Hydro turbine plant course
The Imitations of existing Monitoring system

Existing Monitoring system
The Imitations of existing Monitoring system

SCADA System

Benchmark → Compare → Alarm

Operator → Feedback → Action

Pipeline System → Output
The Imitations of existing Monitoring system

Digital Twin

- R&D
- Wanda Hydraulic model
- Embedded Automated Expert
- FEWS Platform for data processing

SCADA System

- Alarm
- Operator
- Feedback
- Action
- Pipeline System
- Output

Deltarex
Digital Twin, How!

WANDA

• Simulation tool for hydraulic in pipeline system
• Main advantages of WANDA:
  • Build by engineers for engineers
  • Validated against lab and field data
  • Used worldwide by major engineering firms
  • Extensive control module to model normal operation of pipeline including e.g. PID controllers
  • Fully function Python API to run Wanda from Python
Digital Twin, How!

FEWS
- Real time operational data integration platform
- FEWS can gather data from different sources and use it to run different models
- FEWS can visualize the data and raise alarm when values exceed a threshold
- Used world wide for a.o. flood forecasting systems
- Free software
- Can run stand alone or as server-client setup
How to come to a digital twin

- Create hydraulic model of the system
- Calibrate model with measurement data
- Make measurement data available for import in FEWS (SCADA or CSV)
- Configure FEWS
  - Determine performance indicators
  - Setup dashboard
  - Set alarms
  - Etc.

![System performance table](image)
Example system for demonstration purposes

- DN1000 single pipeline 96 km
- Capacity: 1 m$^3$/s
- 4 pumps (3+1) set to control the discharge
- 2 control valve set to upstream pressure of 2.5 barg
- 8 Surge vessels of 100 m$^3$ each
And now?

• If you are interested and want to know what how this can work for your system contact us:
  • Sam.vanderzwan@deltares.nl
  • mina@exergiaengineering.com
Demonstration System

Time: 2020-08-05 04:26:40

[Diagram showing flow and pressure details]