Dynamic Well Simulation, application areas and benefits using OLGA for Wells

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OLGA application areas and
Well Control

- 20 years of Well control simulation with OLGA
- Well control specific interface for OLGA, (OLGA ABC)
Well Control

Essential part of emergency response planning

– Blowout rate estimation
– Relief well design
– Bull heading
– Dynamic kill parameters
  • Kill Rate
  • Pump Pressures and capacity
OLGA for Wells

- Well interface to OLGA
- Workflow and functionality for Dynamic simulation of well scenarios
- Near Wellbore simulator ROCX
Subsea and offshore Wells

- High cost
- Costly to work-over
- High reliability required
- Subsea wells have lower recovery rates
Phenomena requiring dynamic modeling:

- Thermal Transient
- Liquid Loading
- Artificial Lift
- Cross Flow
- Slugging & Surges
- Near Wellbore Effects
- Liquid Accumulation
- Stagnant Mud
A well can be a single flow path

Vertical

Slanted

Horizontal

Undulating
but can also be a complicated network
Accurate performance modeling of the flow control equipment/devices

• Flow Control
  – Choke
  – Check valve
  – ESP and PDP
  – Gravitational separator
  – ESD
  – SCSSV
  – Gas-lift valves
  – ICV and ICD
  – DIACS
  – Sliding sleeves
  – Slotted liner
  – Sand screen

• Controllers
Inflow performance relationship

- Linear and non-linear mass-based IPR
- Constant Productivity Index
- Vogel equation
  - Saturated oil reservoir
- Normalized Backpressure
  - Saturated reservoir (oil/gas)
- Saturated oil wells
- Backpressure equation
  - Gas wells
- Forcheimer model
  - Low pressure gas wells
- Single Forcheimer model
  - High pressure gas wells
- User tabulated IPRs
- Quasi-dynamic inflow performance
  - $P_R$, $T_R$, $PI$, $k-h$, $S$, $D$, $n-C$, GOR, WC... etc are available as time series for input
- ROCX, Near Wellbore simulator
Some examples
Unloading Gas Lifted Well
Well Clean-up / Start-up
Clean-up to Host
Completion Stinger Design

Wellbore flowing pressure (bara)

Completion design 1: cemented and perforated casing
Completion design 2: cemented and perforated casing + passive stinger
Completion design 3: cemented and perforated casing + active stinger

Distance from heel (m)
Production optimization/Procedures

Annulus: ID=0.216 m

Gas Lift Rate

Riser: ID=8", depth: 120 m

Pipe: ID=8", length 4.6km

Depth: 2840 m

Tubing: ID=0.1143 m
Modeling wells in OLGA has become easy.
example; Dry-tree well geometry
Gas lift valves and ESP’s in OLGA

in seconds!

The dropdown list of the valves in the database
Gas lift valves and ESP’s in OLGA

In seconds!
Application areas of transient well flow simulations

Well Flow Dynamics
- Drilling Hydraulics
- Completion Design
- Cleanup
- Well Testing
- Artificial Lift
- Gas Well Deliquification
- Horizontal & Multilaterals
- Well-Pipeline Interaction
- Well-Reservoir Interaction
- Injection
- CO₂ Storage
- SAGD

Well Integrity
- Annulus Pressure Management
- Leakage
- Erosion
- Corrosion
- Equipment Integrity
- Temperature
- Well Control

Well Flow Assurance
- Hydrate
- Wax
- Heavy Oil

Well Surveillance
- DTS
- PLT
- Online/Offline Soft Sensing
- Water Monitoring
Publications: more than 70 papers published

OLGA-for-Wells papers - yearly statistics (1990~)

- General
- Control and Optimisation
- Validation
- Near-Wellbore
- Liquid Loading
- Flow Assurance
- Transient Operation
- Sluging
- Artificial Lift
- Well Testing
- Cleanup
- Smart Wells
- Well Control
- Drilling

Number of papers

Year

OLGA
Summary of Values

• Dynamic simulation has proven value throughout the wells life cycle
  – Planning & Design
  – Start-up
  – Production optimization / trouble shooting

• For Operators
  – Reduced risk, increased production and reduced down time

• For Service Companies
  – New service offers and value added solutions

• For Engineering companies
  – Extending Flow assurance to include the well and near wellbore
  – Offering further value to your client base using familiar tools
be dynamic

Thank you for your attention and...