Mobatec in a nutshell
Overview of Technology and Services
Mobatec Specialisation

Mathematical modelling of all kind of physical and/or chemical processes

Knowledge base → Chemical Engineering

Modelling activities for purpose of:

- Design
- Analysis
- Safety
- Optimisation
- Control
- Real time training simulation
Why Mobatec Modeller

• Use Mobatec to build your modelling infrastructure, get to know your process and get the most out of it!

• A dynamic simulation will greatly shorten startup time and significantly reduce the risk of maloperations.

• Mobatec simulations are easier to adapt, modify and integrate into the process operator world.

• Models are built in up to 2-4 times shorter time and they cost less.

• Increased complexity of models requires better tooling.

• Mobatec Modeller provides assistance in model building and reduces “low-level” modelling errors.

• Increased model knowledge transfer and maintainability.

• Mobatec Modeller models are easy to understand, even without having to “design and build” them.
Business relations
Primary applications & sectors

- Reaction
- Separation
- Polymerization
- Control
- OTS
Mobatec provides:

Mobatec Modeller

- State of the art dynamic modelling environment

Modelling consultancy and assistance

- Model building
- Training
- Education

Operator Training Systems

- Real time operator training
- Control systems testing
1. Advanced Modelling Platform

2. Models & Equations Libraries
   Library models & Equations from library

3. Expert Consulting Services
   Mobatec Model Care & Model Based Innovation Services
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Mobatec Modeller®
Free Demo

The free demo-version of Mobatec Modeller includes Examples and Learning Modules.

Go to www.mobatec.nl and download it for free!
Approaches towards Modelling

**Flow-Sheeters:**

- **Black-box** models
- Low flexibility
- Sequential calculation - Recycle problems
- Good only for rough estimates
- No knowledge on the models needed

**Equation Oriented:**

- White box models
- High flexibility – *low transparency*
- No Recycle problems
- Knowledge on the models needed
- Good for High-Fidelity simulations
- Programming skills needed
The MM approach

Equation Oriented..  
Flow Sheeters..

What is the missing link?

Equation Oriented Flow Sheeter!

Mobatec Modeller

Equation and System based
The MM approach
Mobatec Modeller is:

Equation and System based

- White box models → (knowledge of models needed)
- Flexible → high transparency
- No Recycle problems
- High-Fidelity simulations
- Programming skills **NOT** needed
- Assistance on Initialization
- Assistance on “DOF”
- Equations written (almost as on paper!) and added to the systems by the user
- Code generated by Mobatec Modeller (automatically)
- Complex models look & feel like sum of simple models!
- Easy connection to any DCS provider!

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System Equations:

```plaintext
! System Buffer_Tank (3)
! Balance Equations
pivot = m_H2O_Buffer_Tank
d(m_H2O_Buffer_Tank)/dt == Fm_H2O_Fin - Fm_H2O_Fout
! Algebraic Equations
pivot = A_Buffer_Tank
A_Buffer_Tank = D_Buffer_Tank * D_Buffer_Tank * 3.141592653589793 / 4
pivot = M_Buffer_Tank
M_Buffer_Tank = (m_H2O_Buffer_Tank)
pivot = L_Buffer_Tank
M_Buffer_Tank = rho_Buffer_Tank * A_Buffer_Tank * L_Buffer_Tank
```
Mobatec Modeller

Model building process...

\[ \frac{dT}{dt} = \left[ \Delta H_{Rx}(r_A V) - [UD(T - T_a) + \Sigma F_i \dot{C}_p_i(T - T_0)] \right] / \Sigma N_i \dot{C}_p_i \]

\[ \frac{dV}{dt} = u_0 \left[ C_{ao} - C_A \right] + r_A V \]

\[ \Sigma F_i \dot{C}_p_i = u_0 \Sigma C_{io} \dot{C}_p_i = u_0 C_{Ao} \Sigma \dot{C}_p_i = u_0 C_{Ao} \Sigma \dot{C}_p_i \]

\[ \Sigma N_i \dot{C}_p_i = V \Sigma C_i \dot{C}_p_i = V_0 C_{Ao} \Sigma \dot{C}_p_i \]

! System Equations:

! System COMPRESSOR_DISCHARGE (1.1)

! Balance Equations

pivot = n_H2_COMPRESSOR_DISCHARGE
\[ \frac{dn_H2\_COMPRESSOR\_DISCHARGE}{dt} = Fn_H2\_COMPRESSOR\_L - Fn_H2\_m0019 \]

pivot = n_NH3_COMPRESSOR_DISCHARGE
\[ \frac{dn_NH3\_COMPRESSOR\_DISCHARGE}{dt} = Fn_NH3\_COMPRESSOR\_L - Fn_NH3\_m0019 \]

pivot = n_N2_COMPRESSOR_DISCHARGE
\[ \frac{dn_N2\_COMPRESSOR\_DISCHARGE}{dt} = Fn_N2\_COMPRESSOR\_L - Fn_N2\_m0019 \]

pivot = H_COMPRESSOR_DISCHARGE
\[ \frac{dH\_COMPRESSOR\_DISCHARGE}{dt} = HF\_COMPRESSOR\_L - HF\_m0019 \]

! Algebraic Equations

pivot = nt_COMPRESSOR_DISCHARGE
\[ nt\_COMPRESSOR\_DISCHARGE = (n_H2\_COMPRESSOR\_DISCHARGE + n_NH3\_COMPRESSOR\_DISCHARGE + n_N2\_COMPRESSOR\_DISCHARGE) \]

pivot = Xn_H2_COMPRESSOR_DISCHARGE
\[ n_H2\_COMPRESSOR\_DISCHARGE = Xn_H2\_COMPRESSOR\_DISCHARGE * nt\_COMPRESSOR\_DISCHARGE \]

pivot = Xn_NH3_COMPRESSOR_DISCHARGE
\[ n_NH3\_COMPRESSOR\_DISCHARGE = Xn_NH3\_COMPRESSOR\_DISCHARGE * nt\_COMPRESSOR\_DISCHARGE \]

pivot = Xn_N2_COMPRESSOR_DISCHARGE
\[ n_N2\_COMPRESSOR\_DISCHARGE = Xn_N2\_COMPRESSOR\_DISCHARGE * nt\_COMPRESSOR\_DISCHARGE \]

...
Mobatec Modeller approach

Equation and system based

- Dynamic or Steady State
- Mass & Energy balances for free (generated by MM)
- No programming needed (MM generates the code)
- Library of models & equations
- Easy extendable libraries for predefined units
- High flexibility when incorporating existing user models
- Assistance with DOF of systems
- Assistance with initialization
- Equations physical topology
- Easy to understand
User’s perspective

- **Equation oriented flow-sheeter**
  Custom equation based modelling and “drag-&-drop” flow-sheeting

- **No programming skills needed:**
  Mobatec Modeller generates the code for you

- **Manual model initialization:**
  Ensures a good starting calculation point every time

- **Equation physical topology:**
  High model transparency and maintainability, making any model very easy to understand
**Technology prospective**

Differential & Algebraic Equation (DAEs) solution engine solves models with hundreds of thousands of equations simultaneously.

**Modelling purposes**

- Design
- Analysis
- Safety
- Optimisation
- Control
- Real time training simulation
Interested in learning more?  ➔ http://www.mobatec.nl/web/downloads/

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