Design Pattern Enabling the Flexible Integration of Effects into a Basis Flow Model

Tatiana Reiche, GRS, Germany
InterPore, May 15, 2018, New Orleans, USA
Motivation

RepoTREND – program package for simulation of processes in a final repository for radioactive waste in a deep geological formation (is being developed and applied by GRS).

Specific problems:
- The model area is extremely heterogeneous.
- Numerous different effects have to be considered in addition to the basic process (two phase flow).
- The relevance of effects can change during a simulation.
General Workflow:

1. Dynamically for each region: compose equations of relevant terms accordingly to the relevant effects/processes
2. Create a block matrix for each grid cell
3. Assemble the common Jacobi Matrix
4. Solve a single coupled linear equation system
5. Check for each region: which effects / processes are relevant for the next time step
Specific challenges in developing the structure of a simulator program are:
- to enable a flexible choice of effects for different regions of the modeled area,
- their combination during a simulation,
- an easy way to extend the program by new effects,
- transparency and easy maintainability.

Efficient program structure: separate “effect specific” and “interaction of effects”

<table>
<thead>
<tr>
<th>Library of <strong>Effects</strong></th>
<th>Library of <strong>Experts</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Effect</strong></td>
<td><strong>Expert</strong></td>
</tr>
<tr>
<td>effect specific routines</td>
<td>interaction of currently relevant effects</td>
</tr>
</tbody>
</table>