Head loss estimation in diaphragm type configuration at EDF hydraulic engineering

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**Contextualization and Mesh configurations to optimize computational time**

- Concerns: The surge chamber allows to decrease the high pressure level in the inlet tunnel and penstock.
- The high pressure drop in the diaphragm reduces the water level variation in the surge shaft.
- The sizing of this device is an important part to control water level and to avoid overflowing in the valley.

**Physical phenomena**

- Flow recirculation after the bent
- Pressure drop profiles in unsteady calculation

**Comparison results for different mesh generators with Code_Saturne**

<table>
<thead>
<tr>
<th></th>
<th>K [m^5.s^{-2}]</th>
</tr>
</thead>
<tbody>
<tr>
<td>K hexa mesh</td>
<td>K tetra mesh</td>
</tr>
<tr>
<td>Salomé</td>
<td>K=0.0375</td>
</tr>
<tr>
<td>Element</td>
<td>56889</td>
</tr>
<tr>
<td>Ansys</td>
<td>K=0.0345</td>
</tr>
<tr>
<td>Element</td>
<td>40000</td>
</tr>
<tr>
<td>Experimental</td>
<td>K=0.0240</td>
</tr>
<tr>
<td>Lowest deviation (%)</td>
<td>4%</td>
</tr>
</tbody>
</table>

- Similar results compared with previous computational calculations
- 4% deviation with experimental results for the tetrahedral mesh with fine discretization at the diaphragm surface and boundary layers

**Difficulties encountered**

- Block division for the hexa mesh generation
- \(y^+\) too high in the interest domain even for k-eps model
- Difficulties to handle the meshes defaults
- Divergence solver for boundary layers with hexaedral mesh
- Method for extracting value on a surface

Steady-state algorithm

Unsteady algorithm

K = 0.0375

K = 0.028

Element number

40000

231823

Experimental

K = 0.0240

Lowest deviation (%)

4%