Fluid Structure Interaction (FSI) of Double Curvature Arch Dam Under Seismic Loading By the Application of Added Mass Technique and Acoustic Elements

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Added Mass Technique - The mass and its distribution are relevant for calculating the dynamic analysis during the Earthquake. The water joined to the body dam is added to the points of the upstream face as an additional concentrated mass according to Westergaard’s approach

Acoustic Elements - Pressure variations in the fluid domain by the transmission of sound for the waves
Background and Motivation

The impact of load on the upstream face of the dam is obtained by the computation of stress and displacements for the double curvature Arch dam considering compression of fluid element.

Application of COMSOL Multiphysics in a new area of scope.
Excerpt from the Proceedings of the 2014 COMSOL Conference in Bangalore
## Model Properties

<table>
<thead>
<tr>
<th>Domain</th>
<th>Density [kg/m³]</th>
<th>Poisson ratio</th>
<th>Young modulus [MPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dam Body</td>
<td>2300</td>
<td>0.33</td>
<td>25000</td>
</tr>
<tr>
<td>Rock Strata</td>
<td>2600</td>
<td>0.25</td>
<td>60000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Domain</th>
<th>Density [kg/m³]</th>
<th>Speed of sound in water [m/s]</th>
<th>Bulk modulus [MPa]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reservoir</td>
<td>1000</td>
<td>1500</td>
<td>2200</td>
</tr>
</tbody>
</table>

Excerpt from the Proceedings of the 2014 COMSOL Conference in Bangalore
Modeling Interfaces

- Solid Mechanics
- Acoustic-Solid Interaction Frequency Domain
- Fluid-Structure Interaction
Results

1. Slice Pressure
2. Displacement
3. Von Mises stress
4. Velocity magnitude on the U/S of the dam
5. Von mises stress on the U/S of the dam

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Results

Total Slice pressure is maximum at the top side joints of the dam body.
Results

Maximize picture of total Slice pressure
Results

Contour pressure is minimum at the bottom and maximum at the top of the dam body.
Results

Total displacement of the dam = 0.35 cm

Excerpt from the Proceedings of the 2014 COMSOL Conference in Bangalore
Results

Von Mises stress is at maximum towards the upstream side body of the dam.
Results

Velocity magnitude is maximum on the U/S of the dam and it goes on decreasing towards the body of the dam.
Results

Von mises stress are maximum on the surface of the dam body.
Thank you....