ICOLD
INTERNATIONAL
COMMISSION ON
LARGE DAMS

ICOLD-BW
9th-11th September 2019
MILANO
Numerical analysis of dams

ICOLD COMMITTEE ON COMPUTATIONAL ASPECTS OF ANALYSIS AND DESIGN OF DAMS

15th INTERNATIONAL BENCHMARK WORKSHOP ON NUMERICAL ANALYSIS OF DAMS

Theme A

9 September 2019, Milan, Italy

Dynamic Analysis of Pine Flat Concrete Dam
Acoustic fluid-structural interaction with ANSYS Workbench

CADFEM

stucky
a Gruner company

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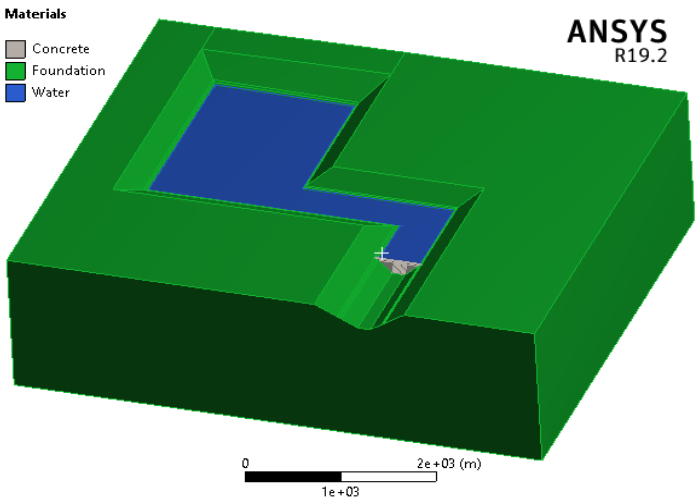
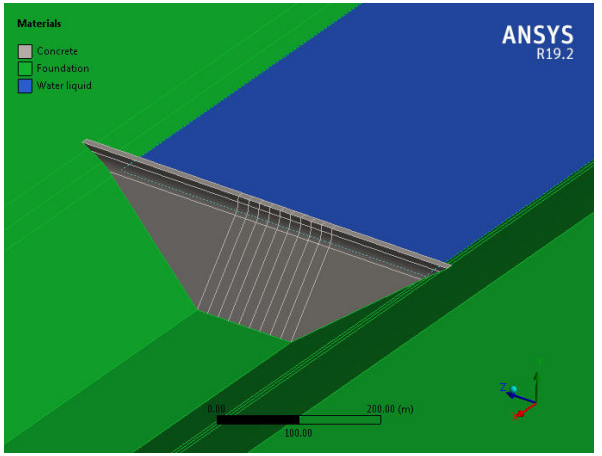
T. Menouillard, A.D. Tzenkov, M.V. Schwager

Particular aspects of the paper presented

- 3D-model of the dam, its foundation and the reservoir
- Fluid structure interaction is addressed introducing an acoustic domain for the reservoir.





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Results of the eigenvalue analysis

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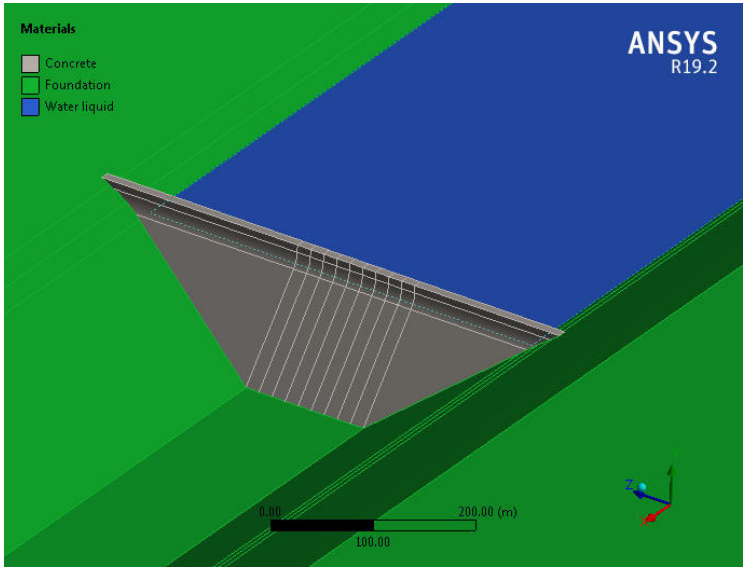
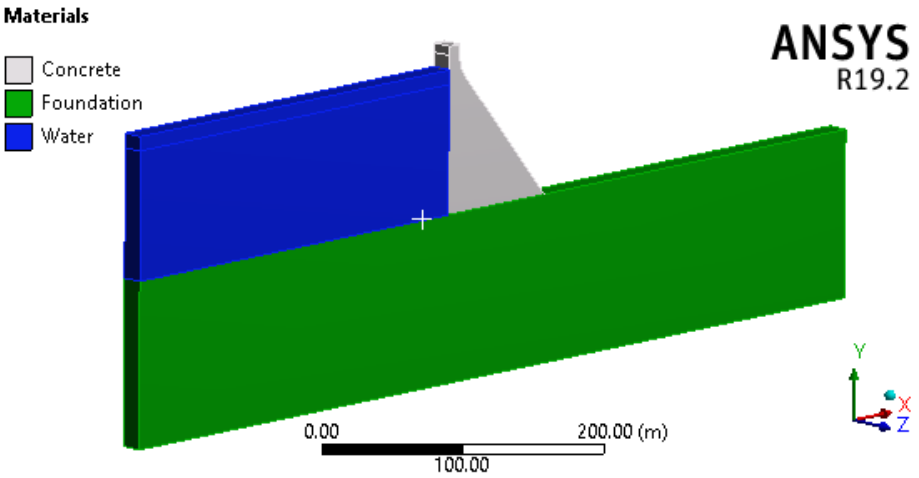
3D-model vs **2D-model** (block no. 16)





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Results of the eigenvalue analysis

1st mode, water level at 268.21m asl

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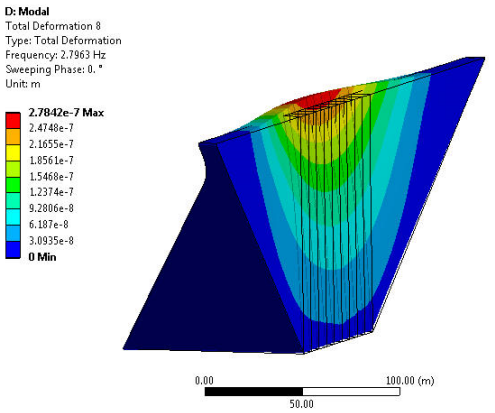
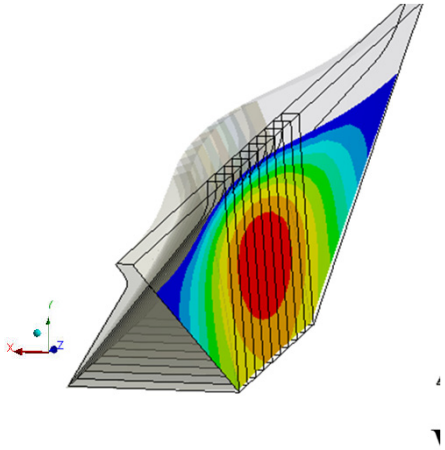
3D-model

f_1 = 2.79 Hz

Total deformation



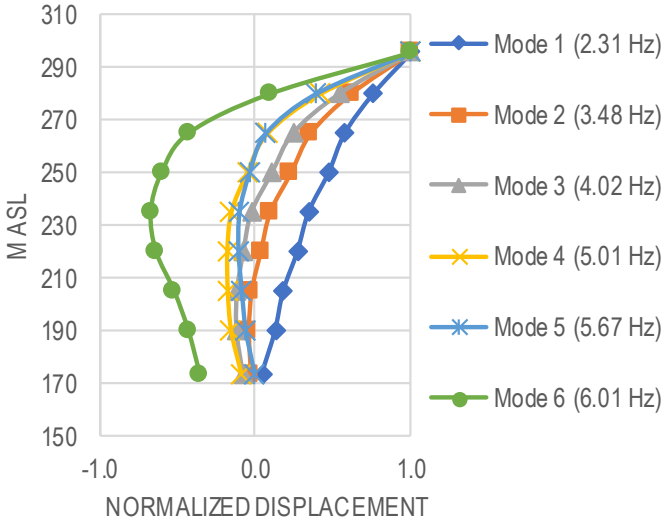
Hydrodynamic water pressures



vs

2D-model (block no. 16)

f_1 = 2.31 Hz



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Results of the eigenvalue analysis

1st mode, water level at 278.57m asl

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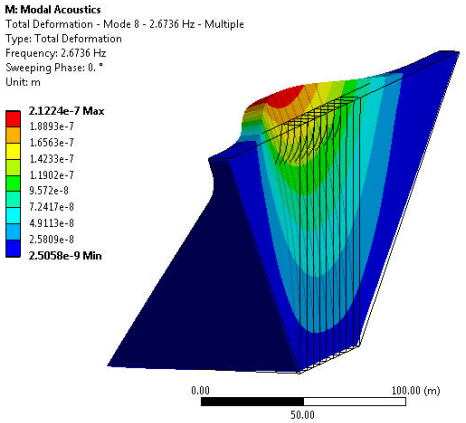
3D-model vs 2D-model (block no. 16)

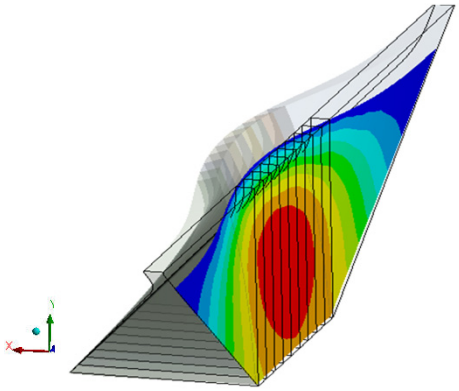
f_1 = 2.67 Hz

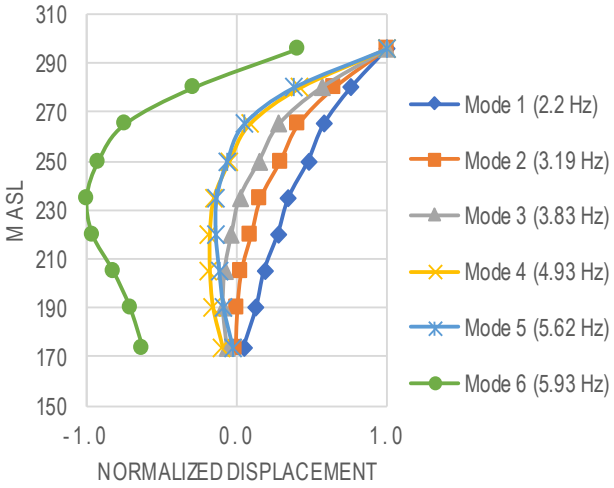
f_1 = 2.20 Hz

Total deformation



Hydrodynamic water pressures





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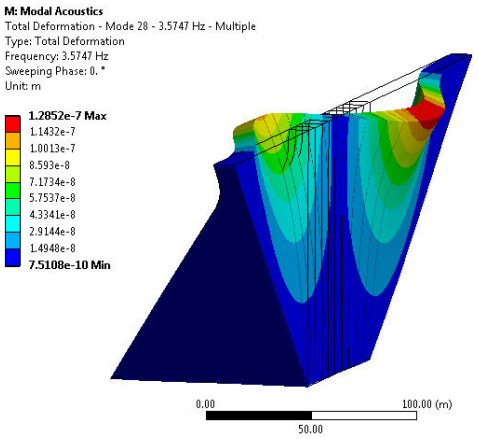
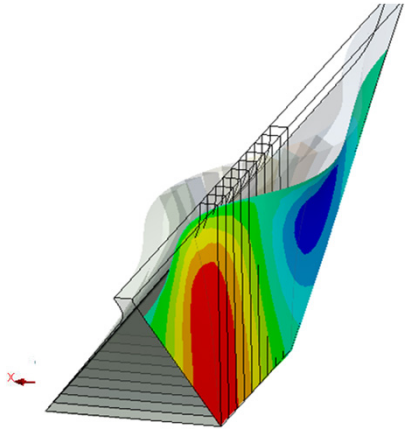
Results of the eigenvalue analysis

2nd and 3rd mode (3D-modes), water level at 278.57m asl

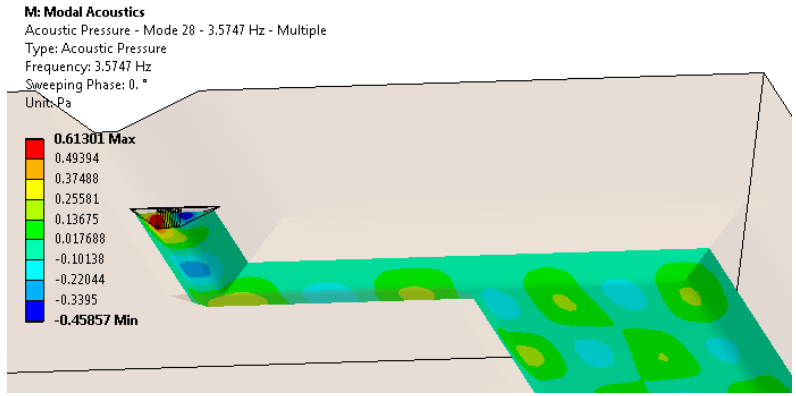
2nd mode, f_2=3.57 Hz



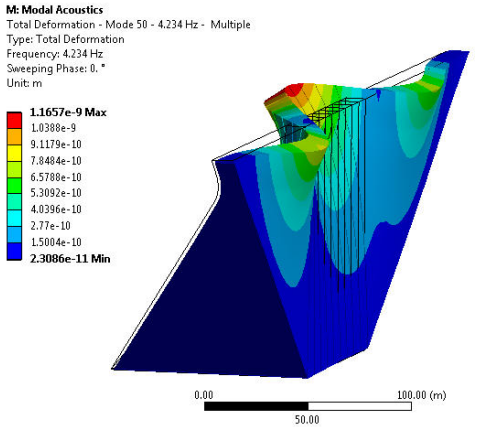
Total deformation



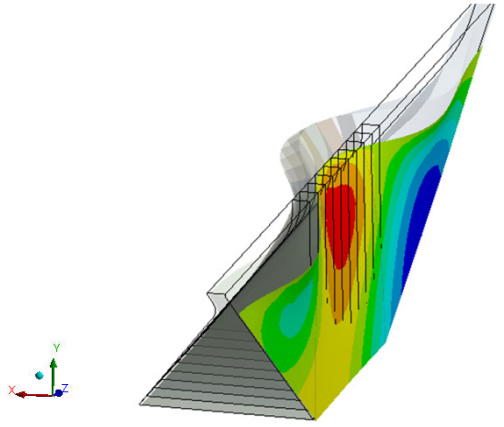
Hydrodynamic water pressures



3rd mode, f_3=4.23 Hz



Total deformation



Hydrodynamic water pressures

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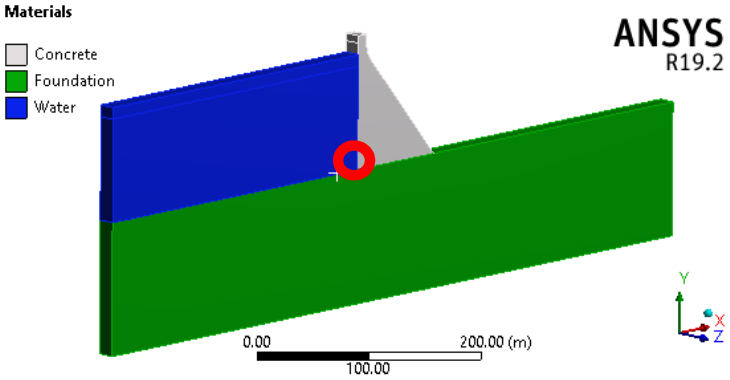
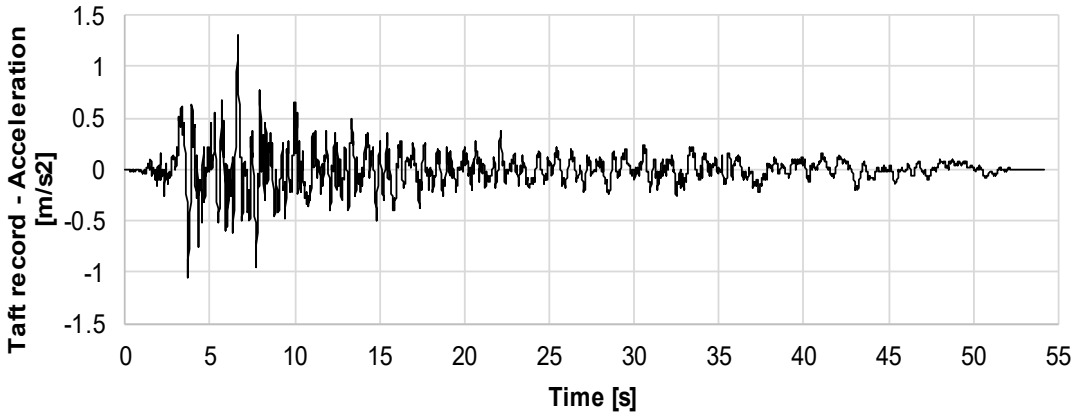
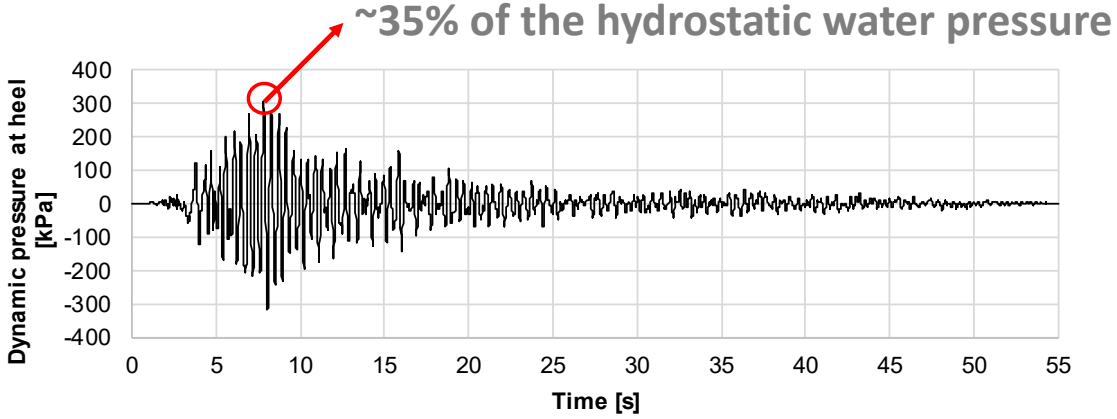
Results of the seismic analysis (2D)

Hydro-dynamic water pressures







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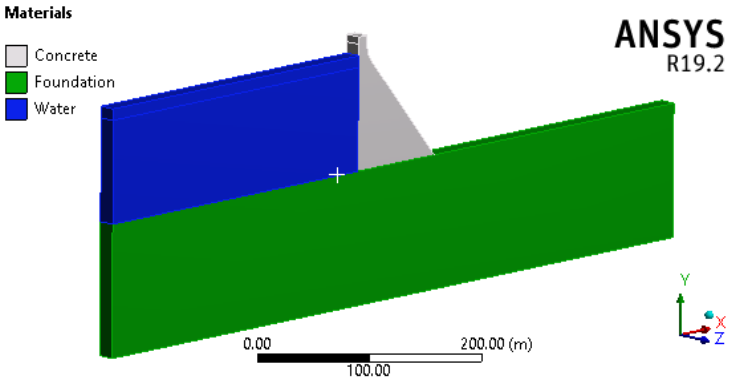
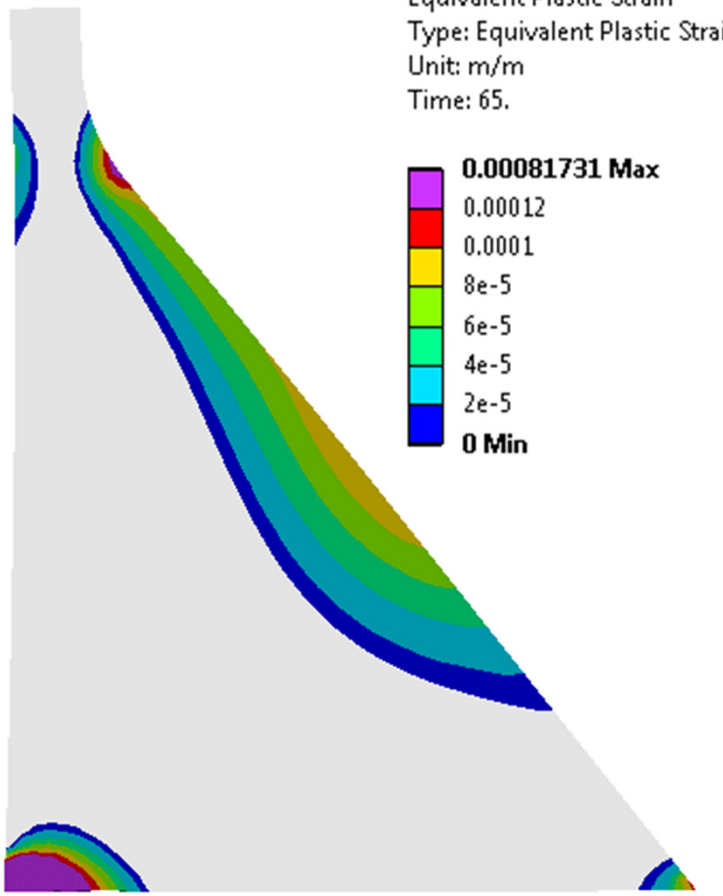
Results of the seismic analysis (2D)

Plastic strains (Drucker Prager perfect plasticity)





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Conclusions

- Using todays computational tools, the 3D-geometry of the dam, the valley and the reservoir can be taken into account.
- As to be expected, the fundamental frequency is found to be higher for the 3D-model than for the 2D-model.
- The eigenfrequencies of the three dimensional modes are in the same range than the higher eigenfrequencies of the 2D-model.
- Introducing an acoustic domain is found to be appropriate to account for hydrodynamic water pressures.