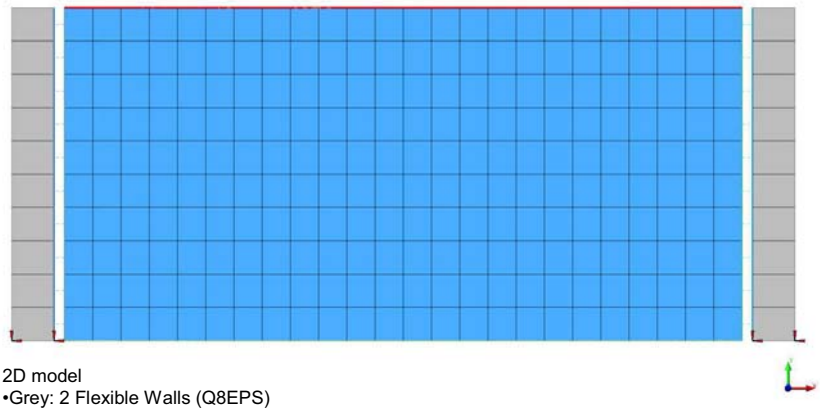
DIANA
Fluid Structure Interaction

TNO DIANA
A TNO Company

DIANA equivalent for model thesis M. Walenda



2D model
•Grey: 2 Flexible Walls (Q8EPS)
•Blue: Fluid (Q4HT)
•Interfaces: Fluid Structure Interfaces (BL4S2)
•Red: Free Surface (B2HT)

HFTD Analysis

Hybrid Frequency Time Domain (HFTD) Analysis

Combination of modal frequency response analysis (linear) and nonlinear transient analysis

Applicable to dynamical systems where the response is mildly nonlinear and frequency dependent

- Evaluate the finite element model
- Solve eigen value problem
- Perform mode reduction
- HFTD analysis:
  - FFT transformation of driving signal
  - Compute modal participation in frequency domain
  - Inverse FFT of solution to time domain
  - Check force equilibrium, iterate if necessary

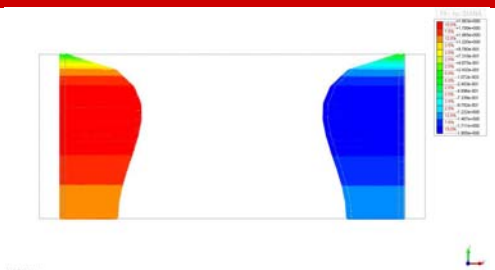
Hybride Frequency-Time Domain analysis

```
'MATERI'
   1 NAME   "Fluid"
     CONDUC  1.00000E+000
     CSOUND  1.93200E+003
   2 NAME   "Wall"
     YOUNG   2.00000E+011
     POISON  0.20000E+000
     DENSIT  2.50000E+003
   3 NAME   "FS_Interface"
     DENSIT  6.00000E+002
   4 NAME   "Free Surface"
     GRAVAC  1.00000E+001
```

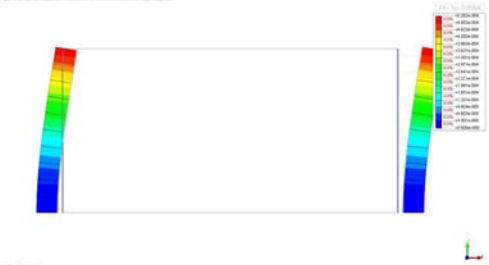
```
'SUPPOR'
/ 276 308 297 315 / TR 1
/ 276 308 297 315 / TR 2
'LOADS'
CASE 1
BASE
  1  1.
'TIMELO'
LOAD 1
TIMES  0.-36.(0.01) /
FACTOR IMPORT "factors.txt"
```

```
*filos
 initia
*input
*hftd
 model matrix dampin
 begin eigen
  execut nmodes=5
  output off
 end eigen
 begin respon
  begin execut
   maxfre=10.
   timese explic number=4096
   begin iterat
    maxite=20
    conver force tolcon=1.E-3
   end iterat
  end execut
  begin output tabula
   begin select
     steps 20-3600(20)
     elemen 250 / nodes 1 /
     nodes 286 /
   end select
   displa x
   accele x
   fspres
  end output
 end respon
*end
```

Results

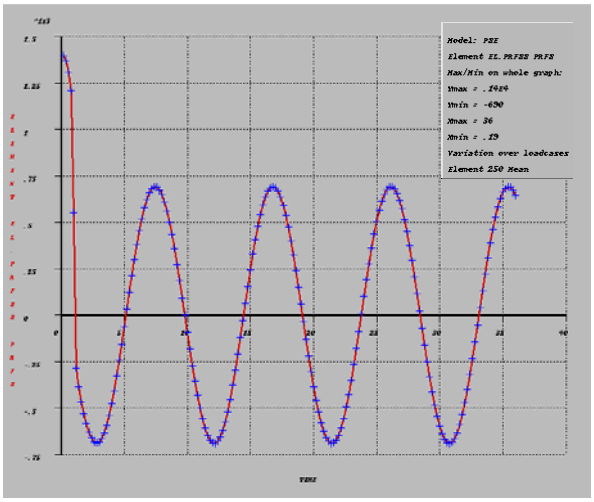


Dynamic Fluid pressure at fluid-structure interface at t=6.99s.



Deformations of walls at t=6.99s.

Results DIANA versus results Walenda



Dynamic fluid pressure at left top corner of fluid domain.

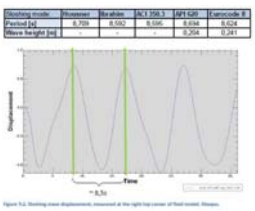
T_{period} = 8.5 s.

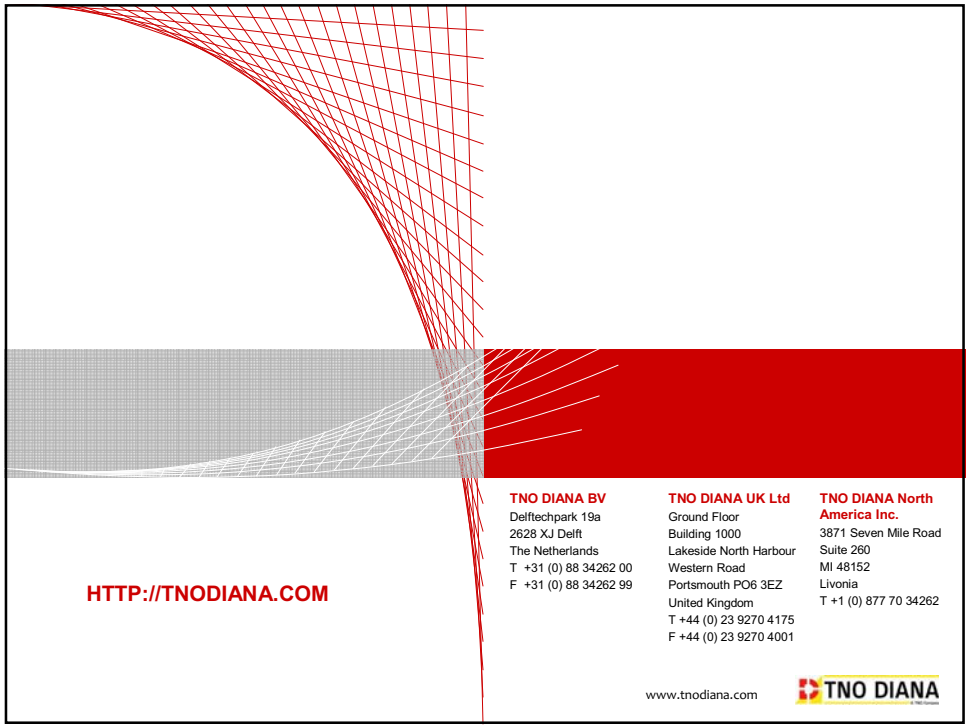
Amplitude = 2*690 N/m2

P=1380 N/m2
rho=600 kg/m3,
g=10 m/s2

P = rho*g*H →

H = 0.23 m





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