# 建筑行业ANSYS 系列工具仿真概述

杨帆 / 工程师

ANSYS

ANSYS仿真在建筑设计中的应用

ANSYS 仿真平台

SYSTEMS

MULTIPHYSICS

PLATFORM

FLUIDS

STRUCTURES

ELECTRONICS

SEMI CONDUCTORS

EMBEDDED SOFTWARE

结构仿真

　　　August 3, 2017　　　ANSYS UGM 2017
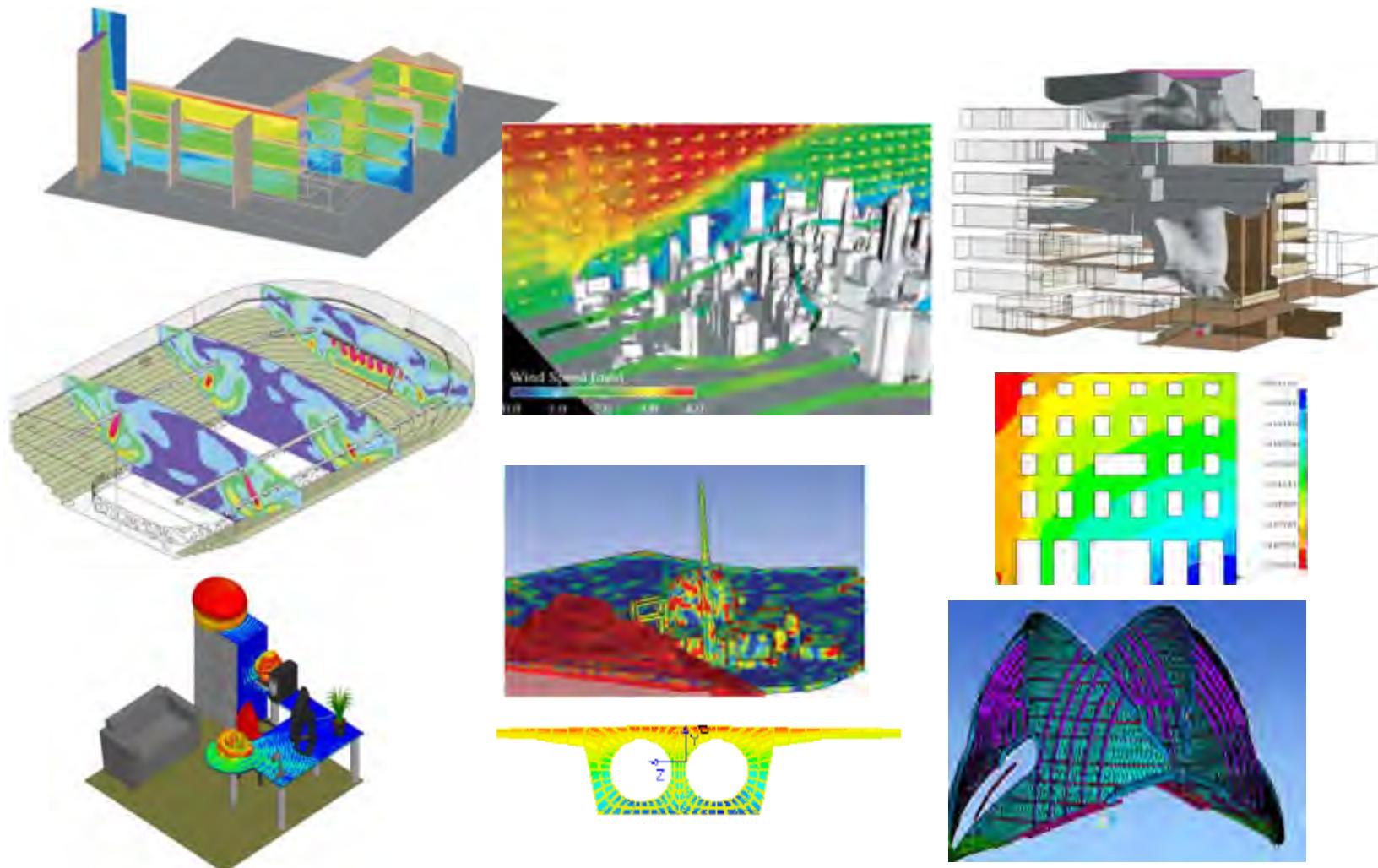
一般工况

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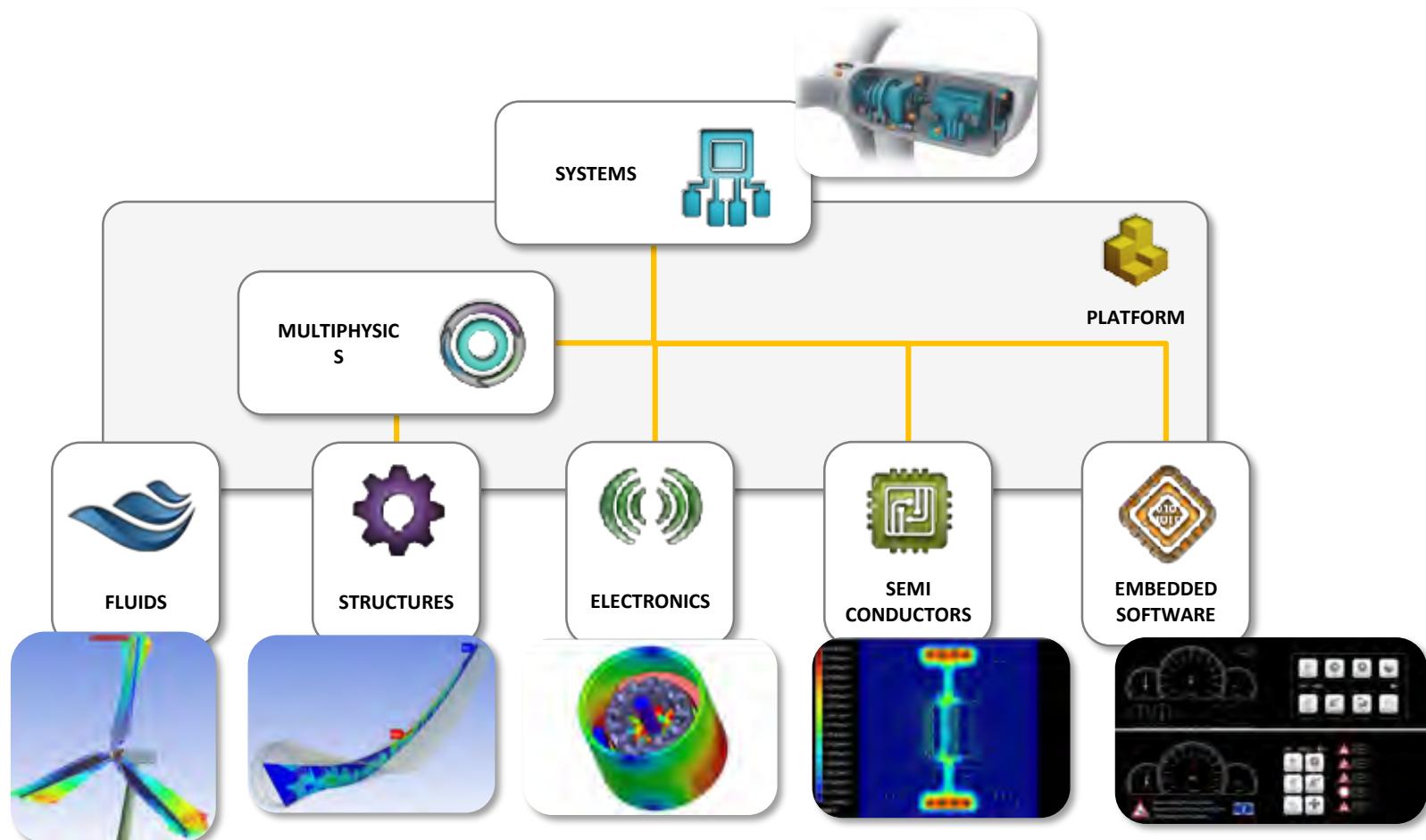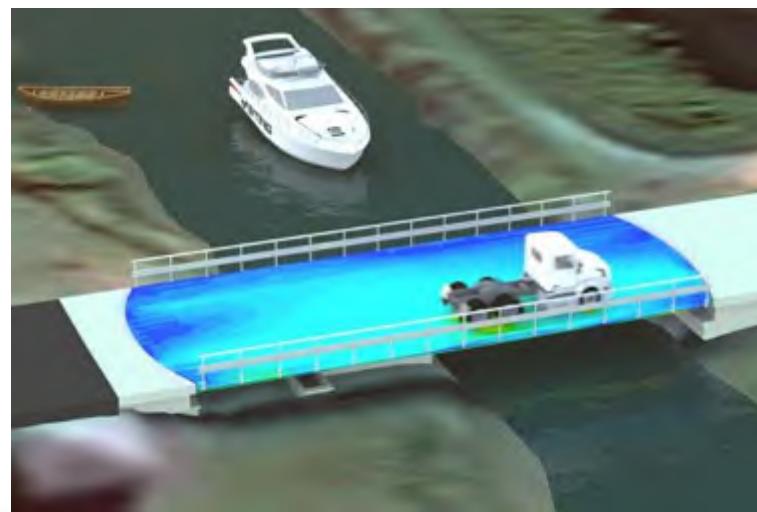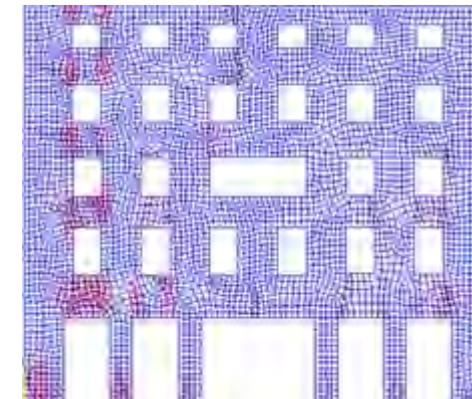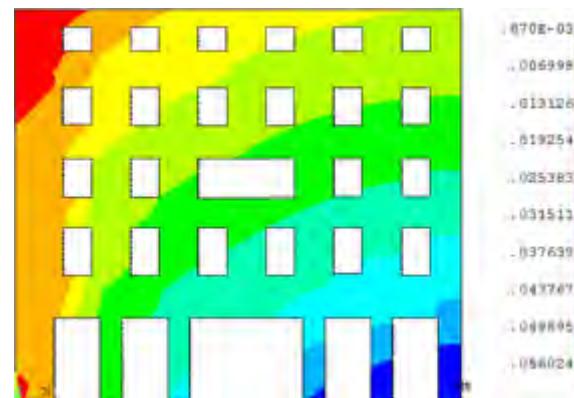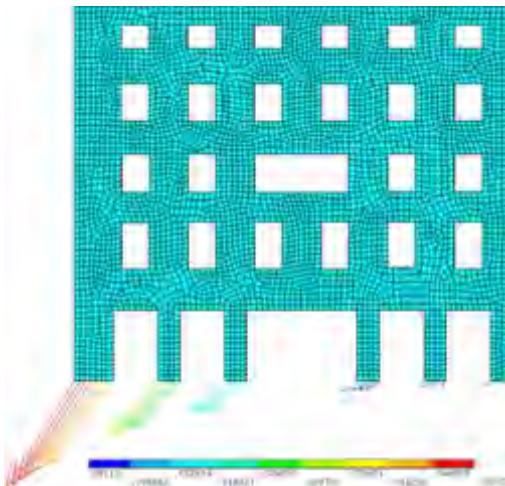
地震
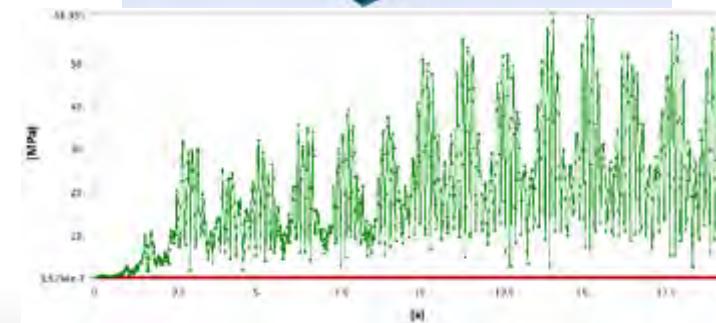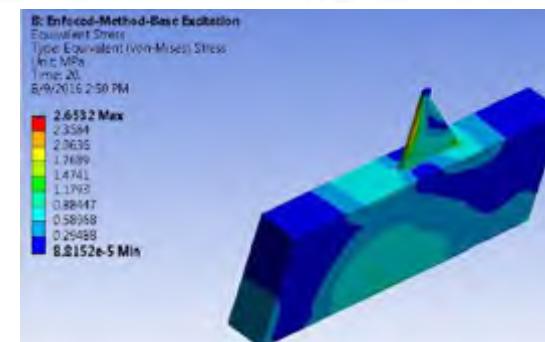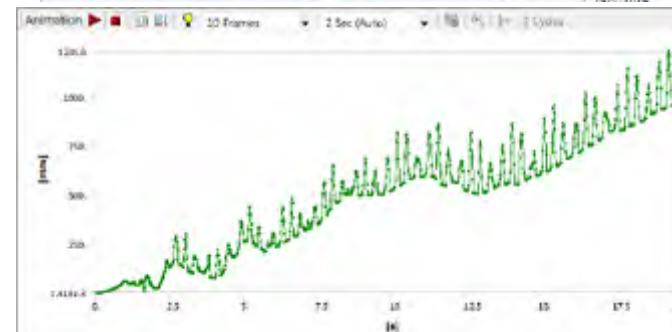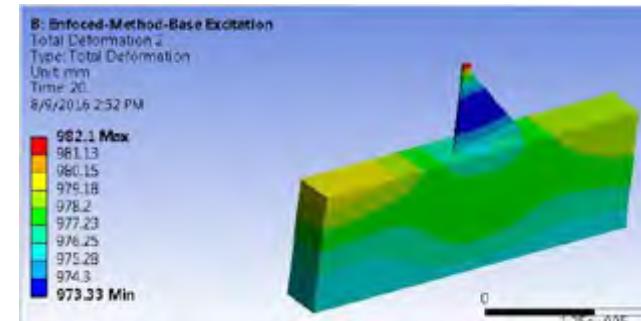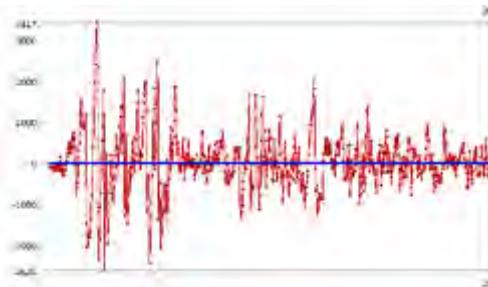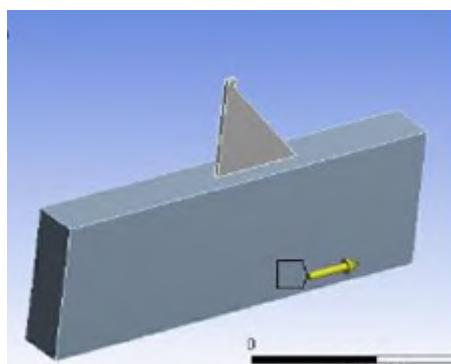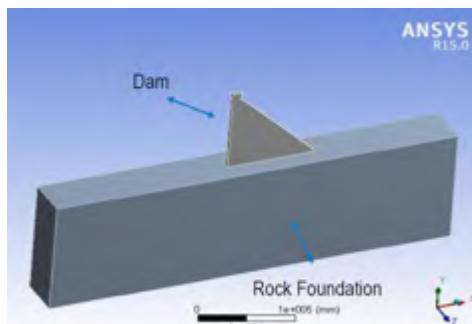
爆炸
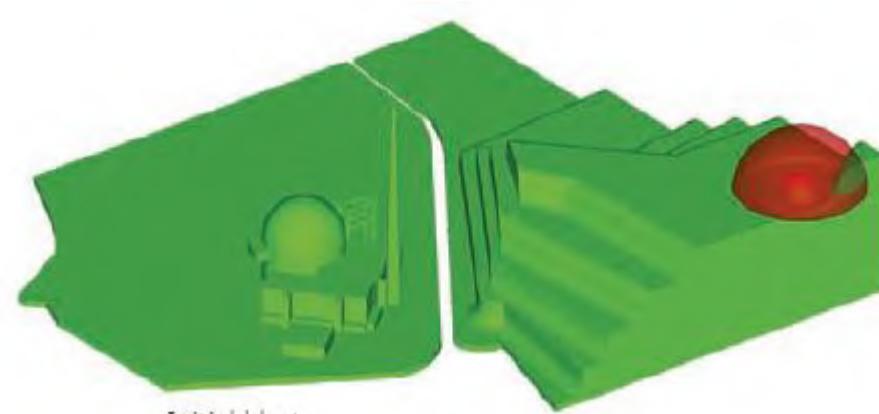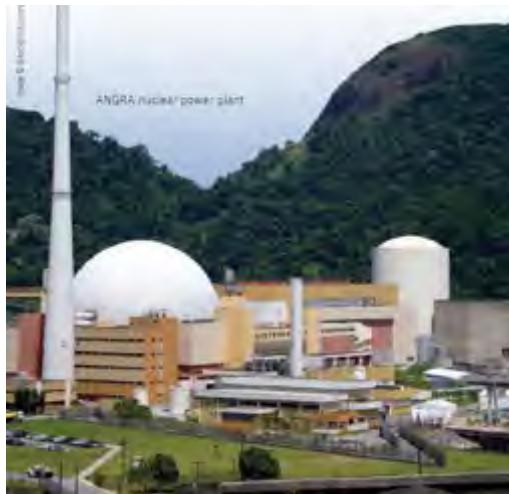
Initial blast
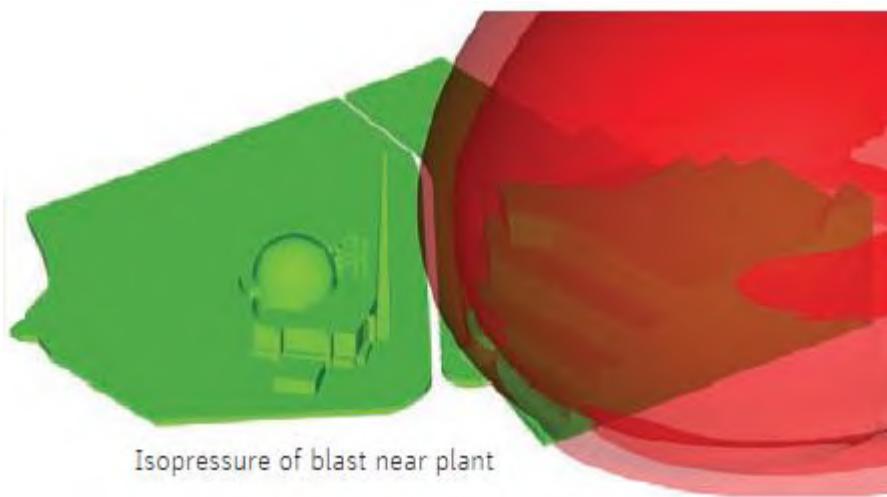
Isopressure of blast near plant

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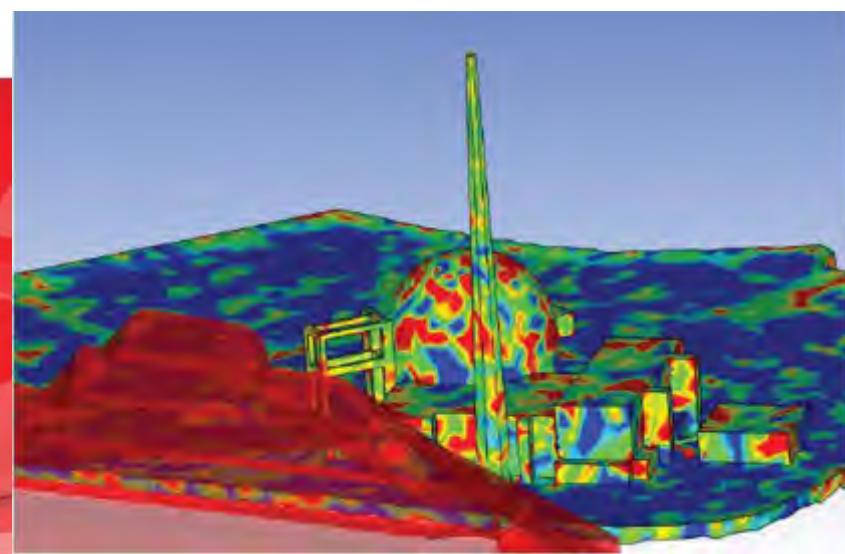
采用混凝土（蠕变）材料的桥梁建造过程仿真

- Advanced concrete modeling
  - Simplified and accurate creep modeling
    - Step by step method
    - Effective modulus method
      - American Code ACI 209R-92
      - EHE
      - CEB -90 CODE
      - EUROCODE 2

*Non-Linear Materials*

Creep and Shrinkage definition

KCreep   EMM
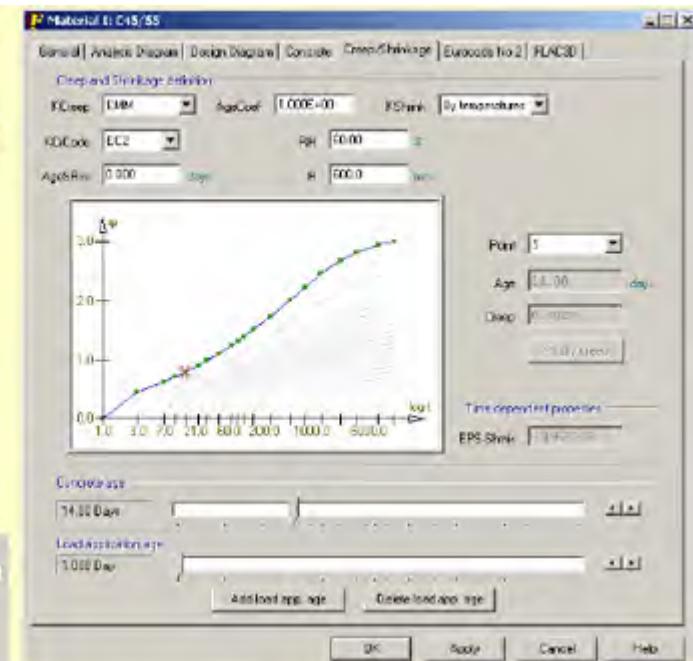
- Construction process through material definition: Material birth and death

□ Civil Preprocessor
  ⊞ Element Types
  ▤ Materials
  ▤ Cross Sections
  ▤ Shell Vertex
  ▤ Member Properties
  ▤ Beam & Shell Properties
  ▤ Solid Section
  ▤ Verif. Database
  □ Construction Process
    ▤ Update Database
    ▤ Active Time
   ▤ Update Construction Stage
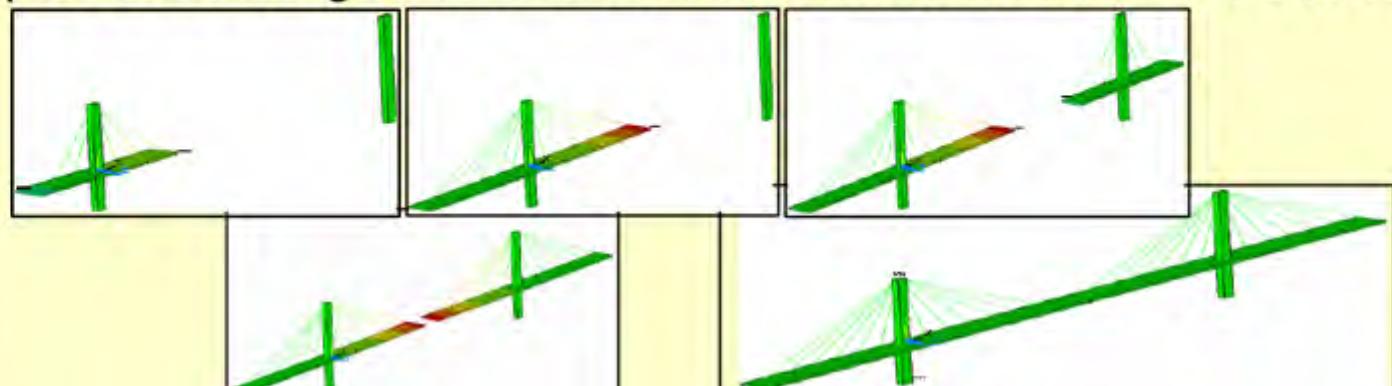
电线杆

- Steel tubes

- High slenderness

- Bolted and/or welded connections

- Multiple load cases (combined)

- Fatigue
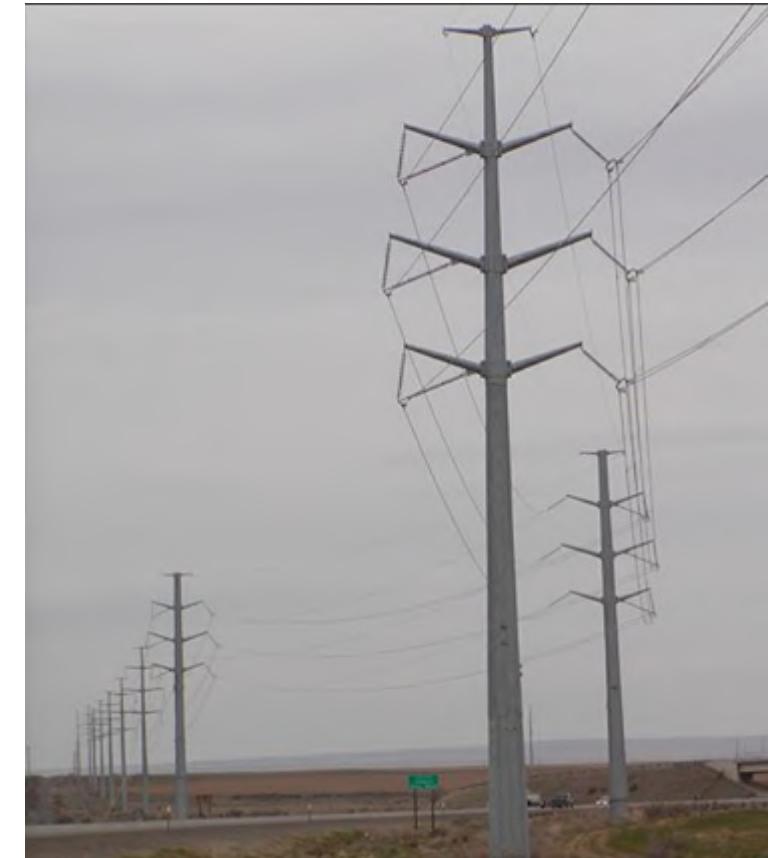
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ANSYS Solution

A single workbench project with different analysis systems:

- Static
- Prestressed Modal (vibration)
- Submodel (details with Fatigue)
- Dynamic
- Load Cases Combination
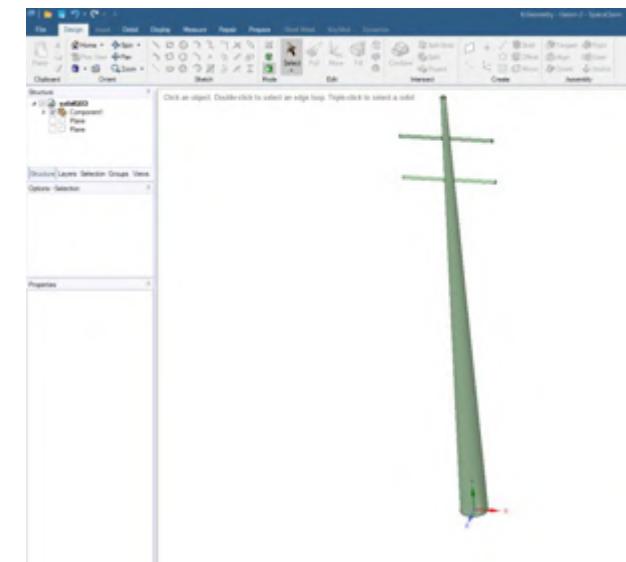
Geometry setup

ANSYS Spaceclaim DirectModeler

- Initial geometry solid 3D

- Midsurface extraction

- Clip with volume to isolate one node
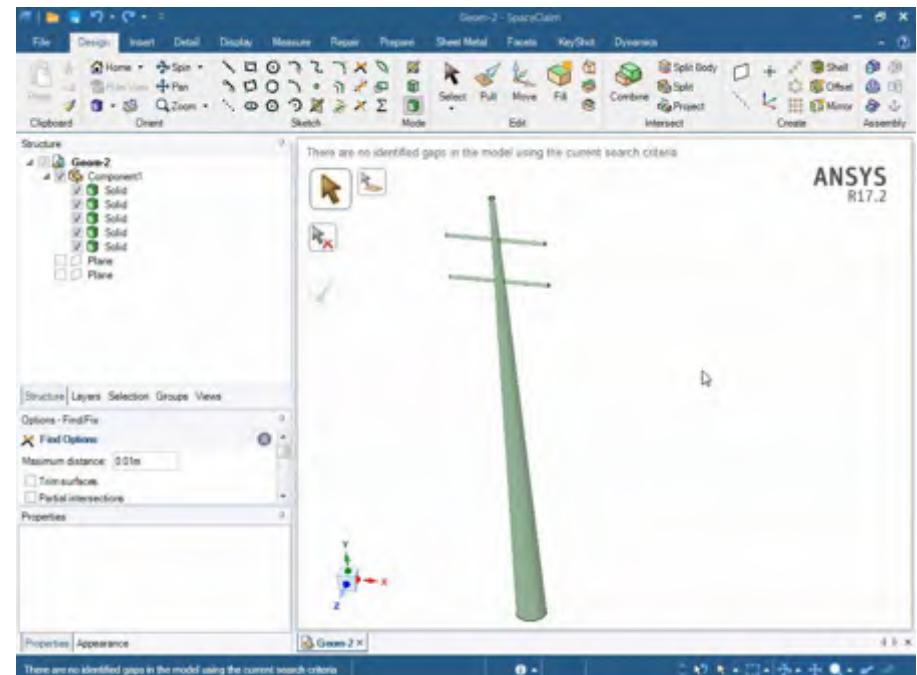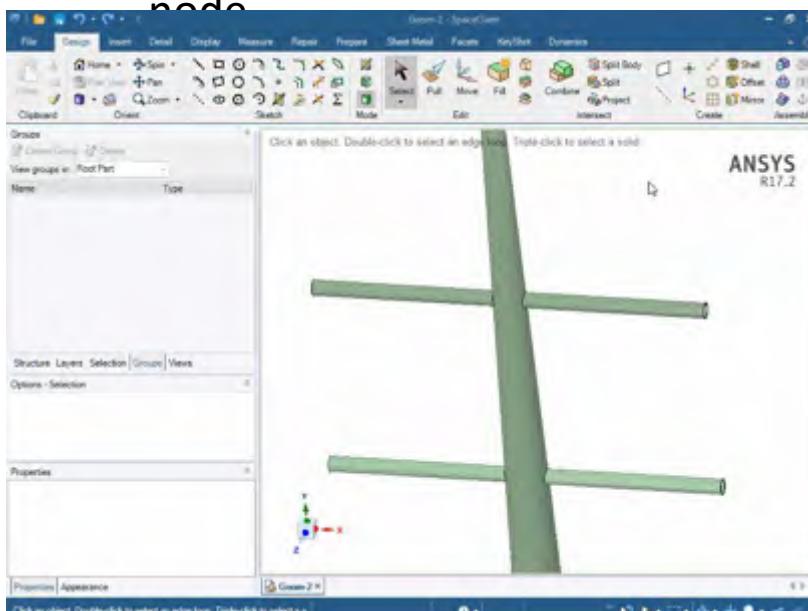
Static and Prestressed Modal

Static load
- Earth Gravity
- Load from cables
- Fixed at the bottom
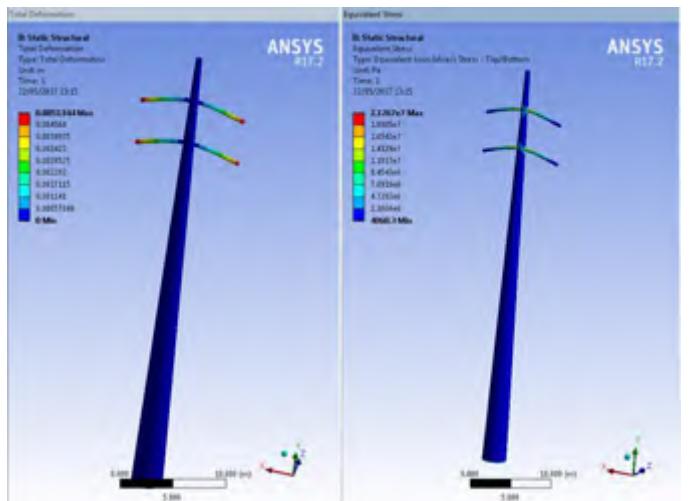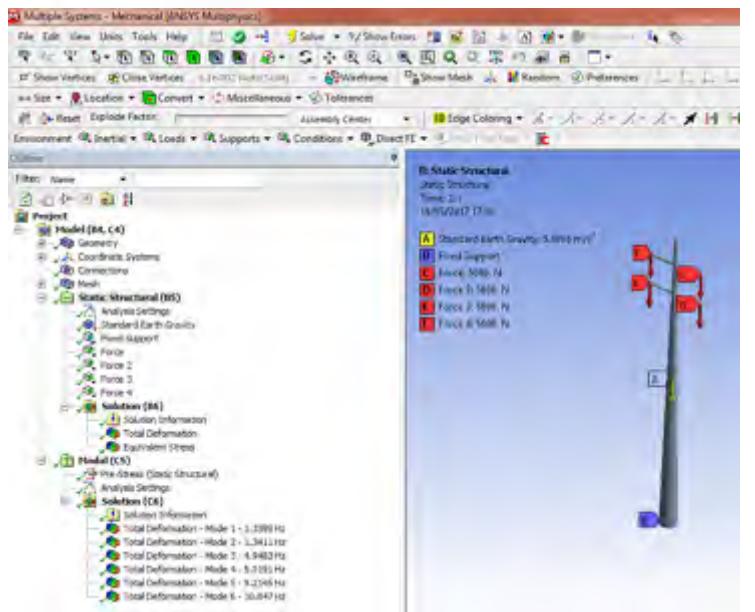
Static Analysis results
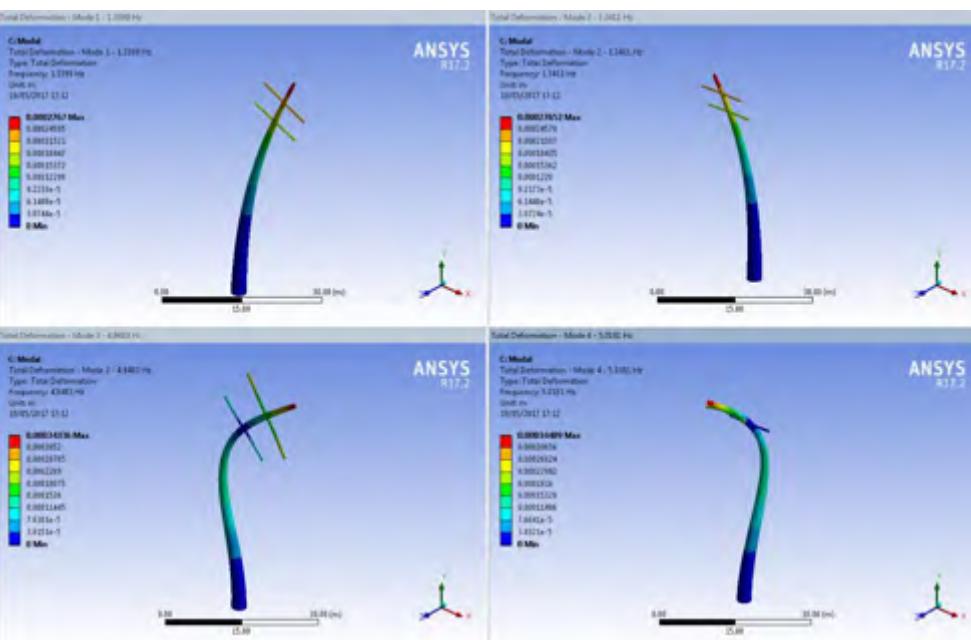
Mode shapes (first 4)

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Submodel with Fatigue
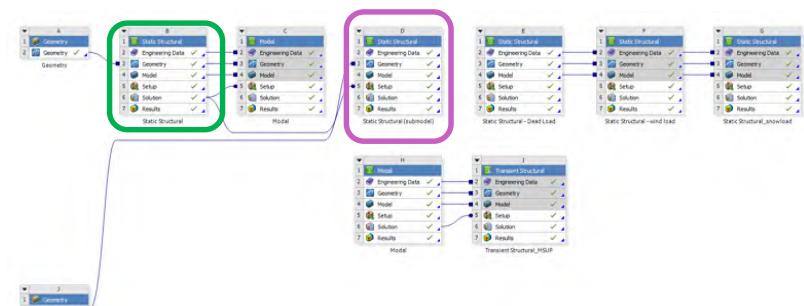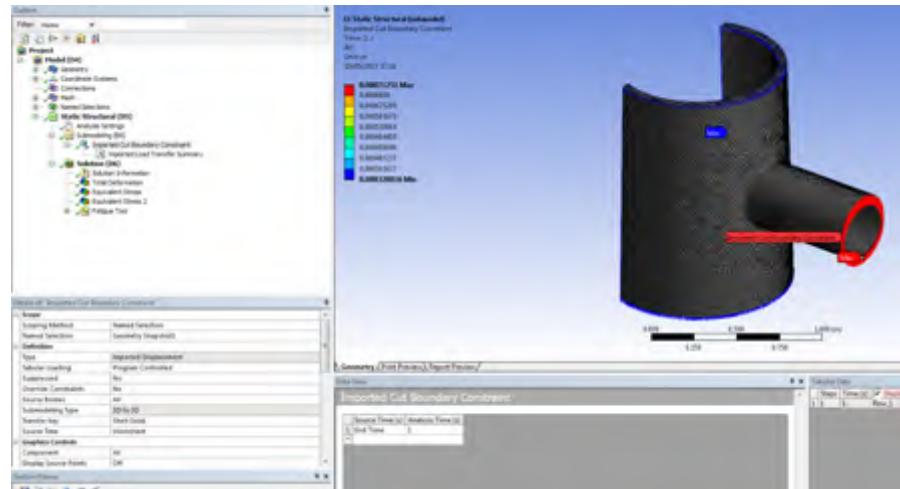
Load (displacements) are transferred from the Static Analysis (cut boundaries)
Note (added
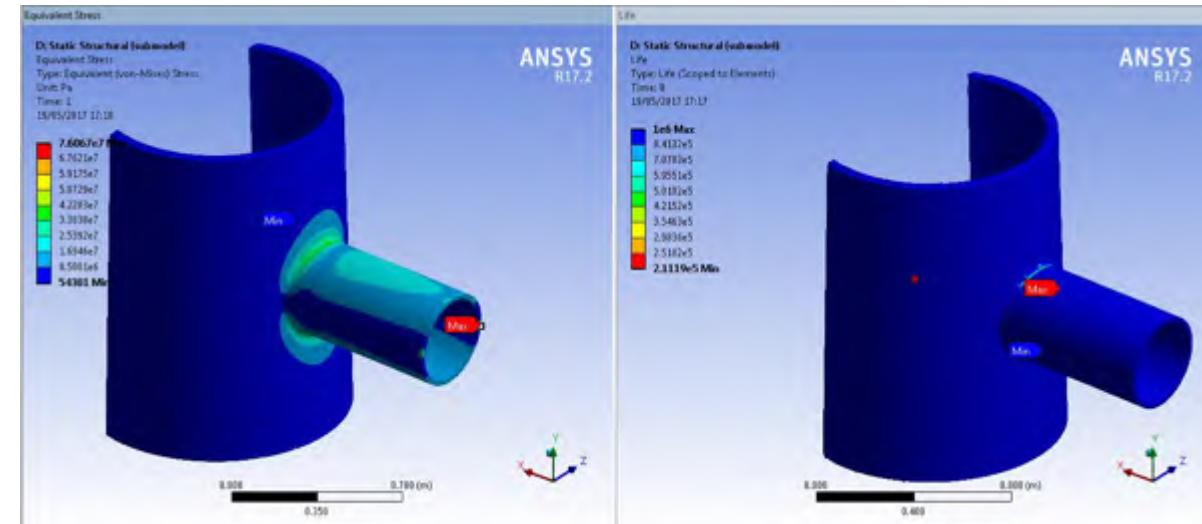
Results:
- Equivalent stress
- Fatigue Life

Load Cases Combination
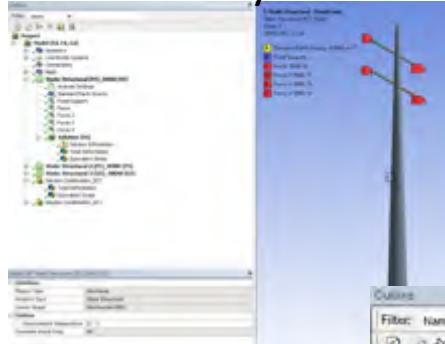
Gravity Load   Wind Load   Snow Load
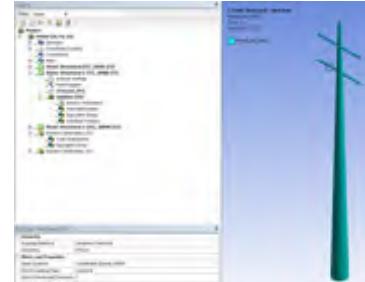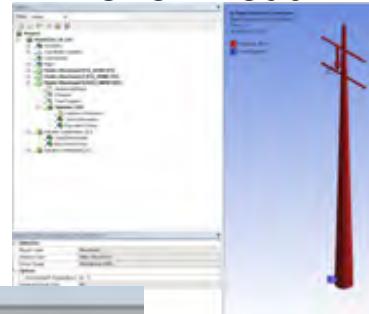
Solution Combination_SC2

Right click on the grid to add, modify and delete a row.

	Coefficient	Environment Name	Time
☑	1	Static Structural (E5)_DEAD	End Time
☑	0.6	Static Structural 2 (F5)_WIND	End Time
☑	0.5	Static Structural 3 (G5)_SNOW	End Time
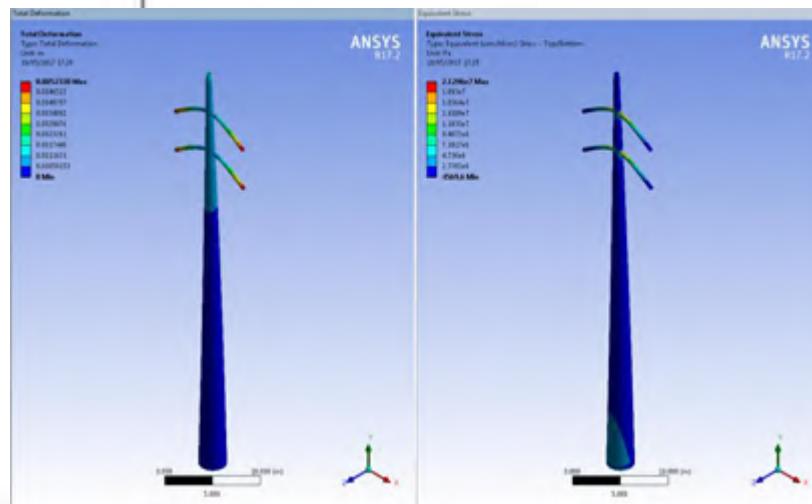
- Results are linearly combined
- No need of resolve
- Wind load applied via ACT

=

WindLoad ACT

- ACT extension free to download from our App Store
- It calculates the pressure exerted to structure (shell model) based on the velocity profile
- The pressure is then applied as varying pressure load

Windloading

$$F_d = \frac{1}{2}\rho v^2 A C_d$$

- Fd = Wind Loading Force
- Rho = Air density
- V = Wind speed
- A = Surface area
- Cd = Drage Coeffiecient (not use)
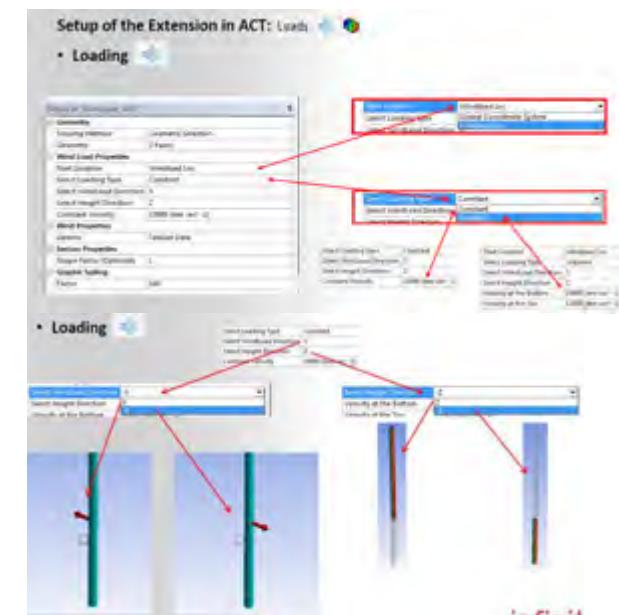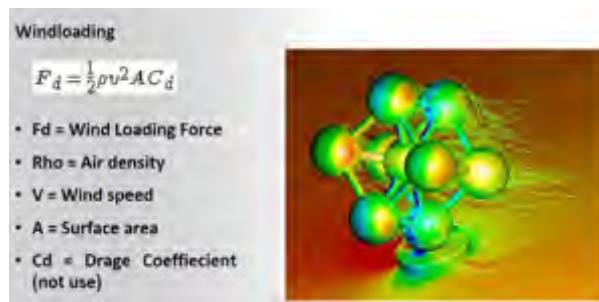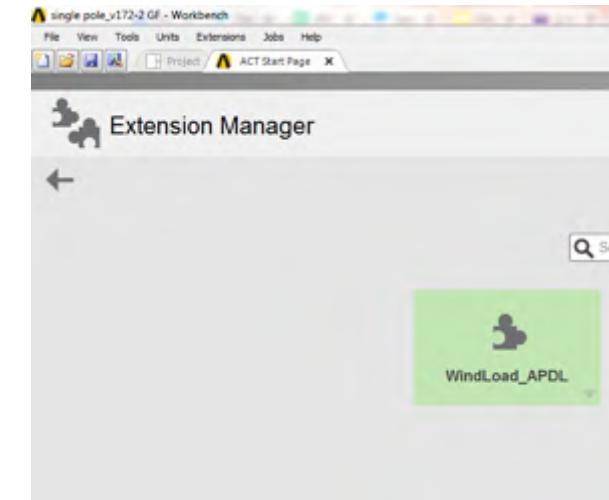
Dynamic Analysis
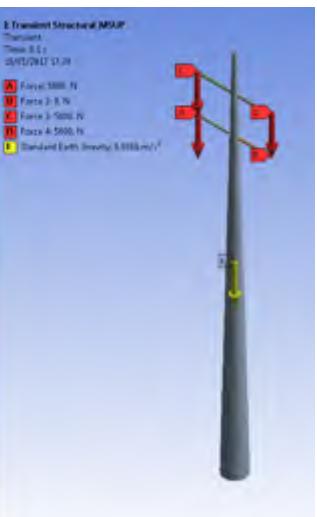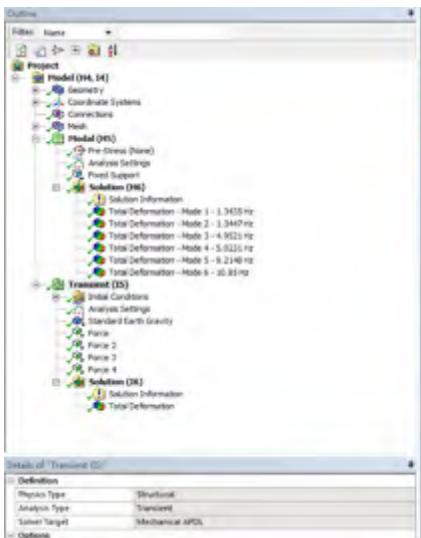
Boundary conditions:
- Same as in the static analysis
- Load from one cable is removed at 0.1sec
- Structure is then set free to vibrate

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流体仿真

August 3, 2017

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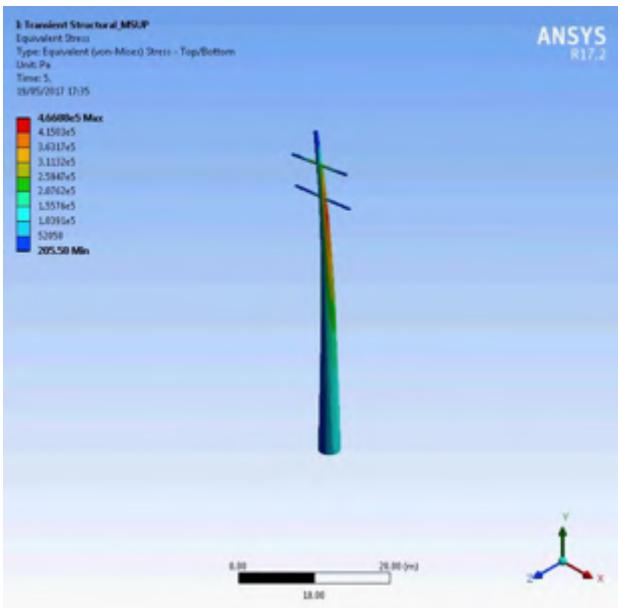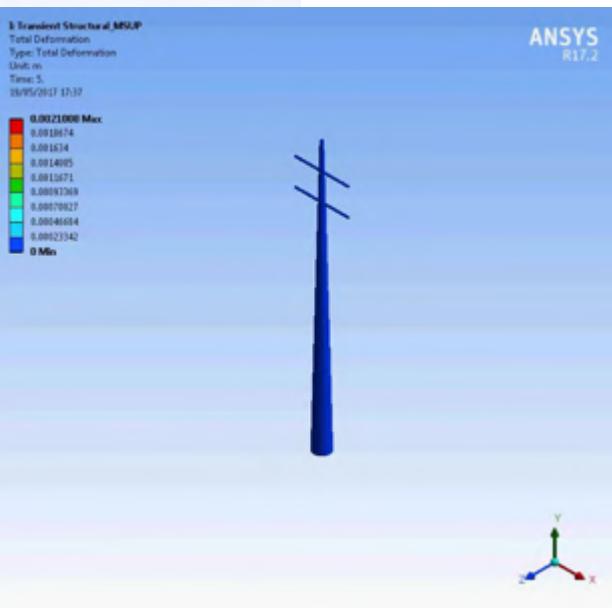
# 大型露天场馆的通风
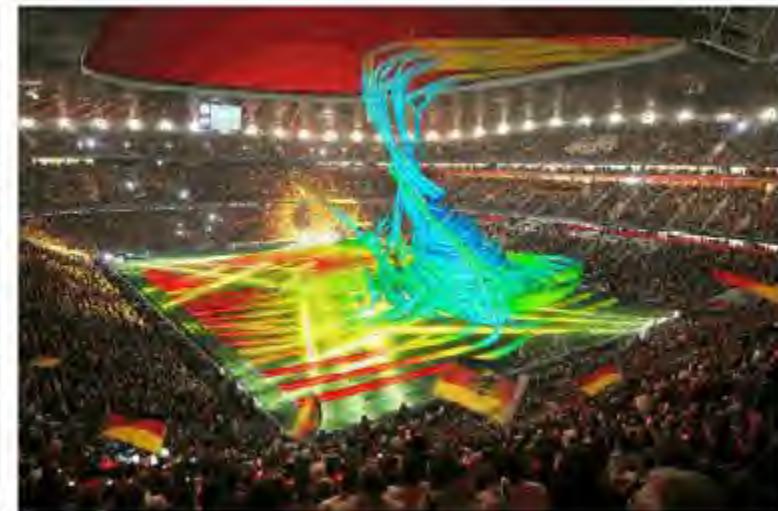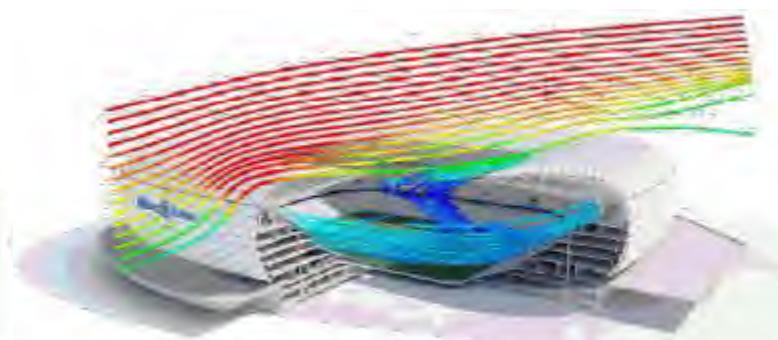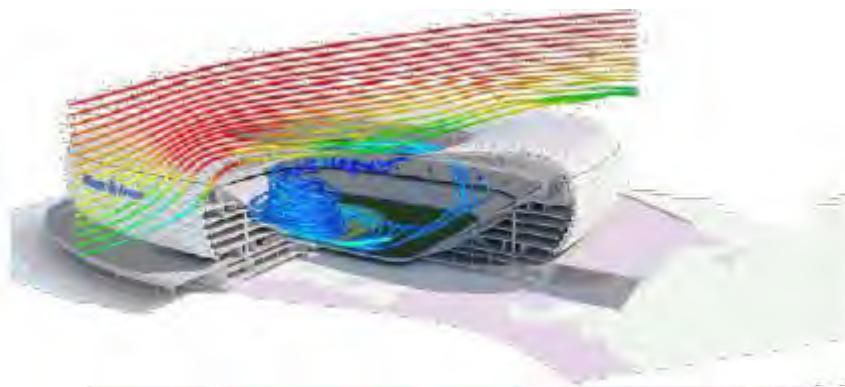
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大型密闭建筑物内的环境控制
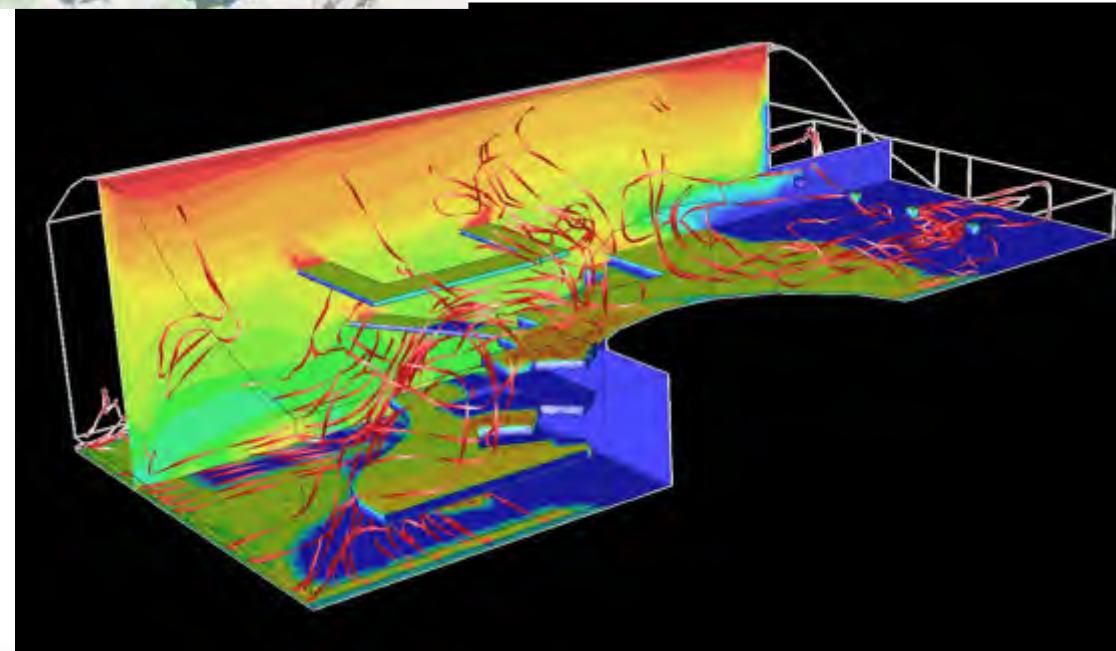
房间舒适度分析

建筑物风载计算

水管理
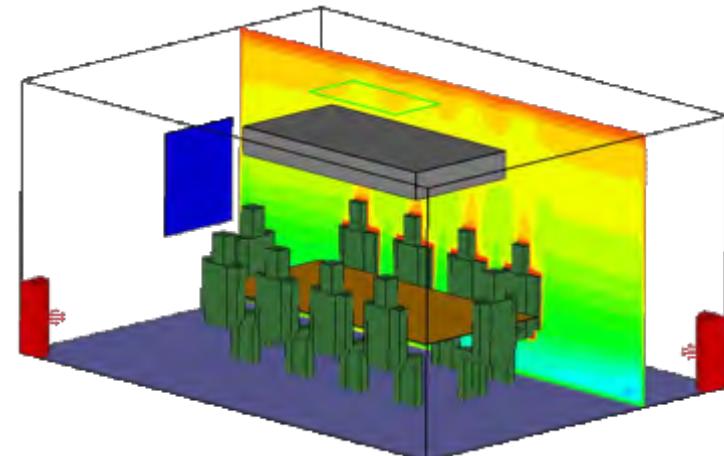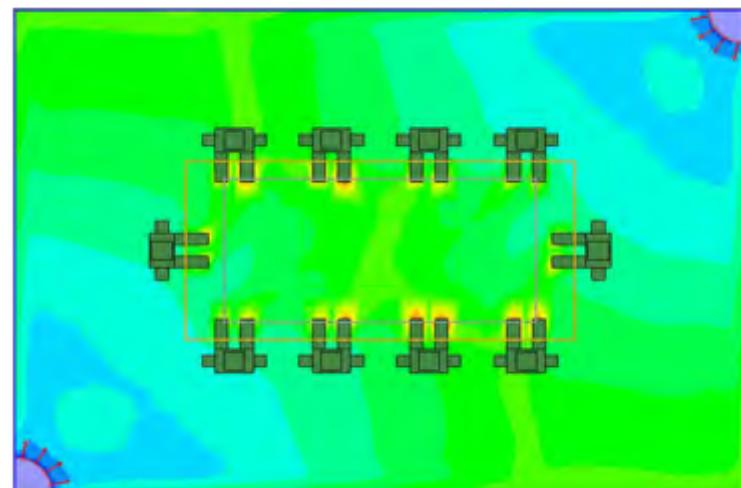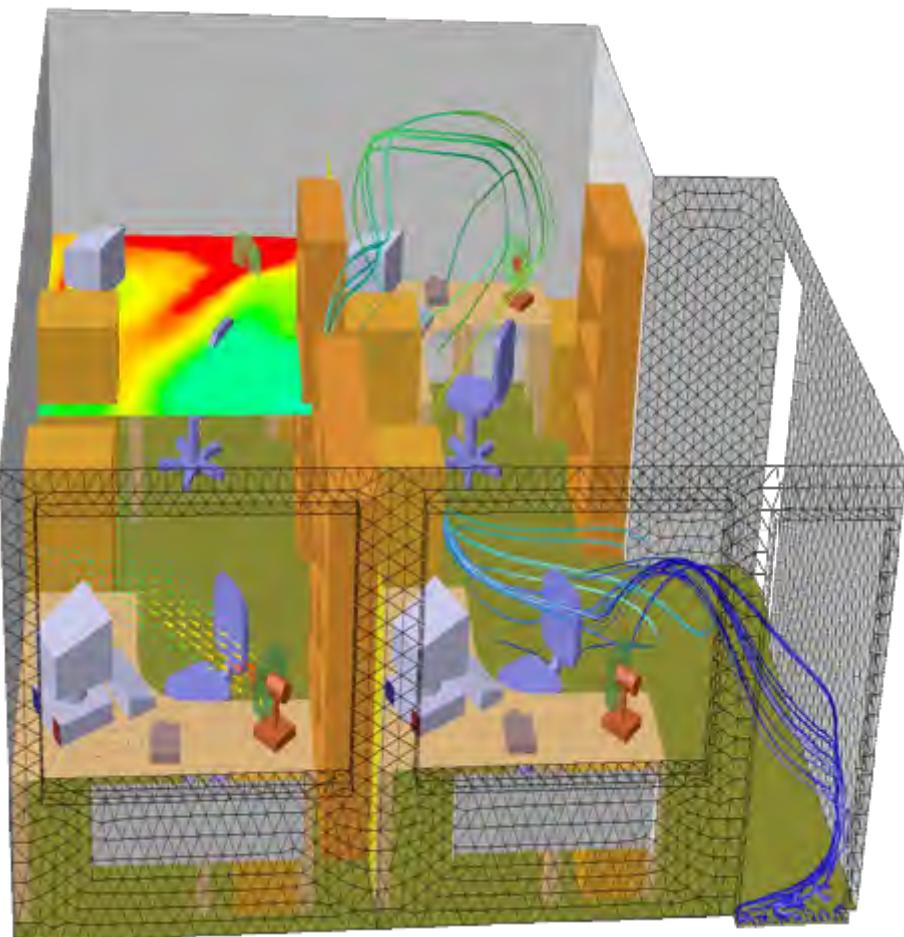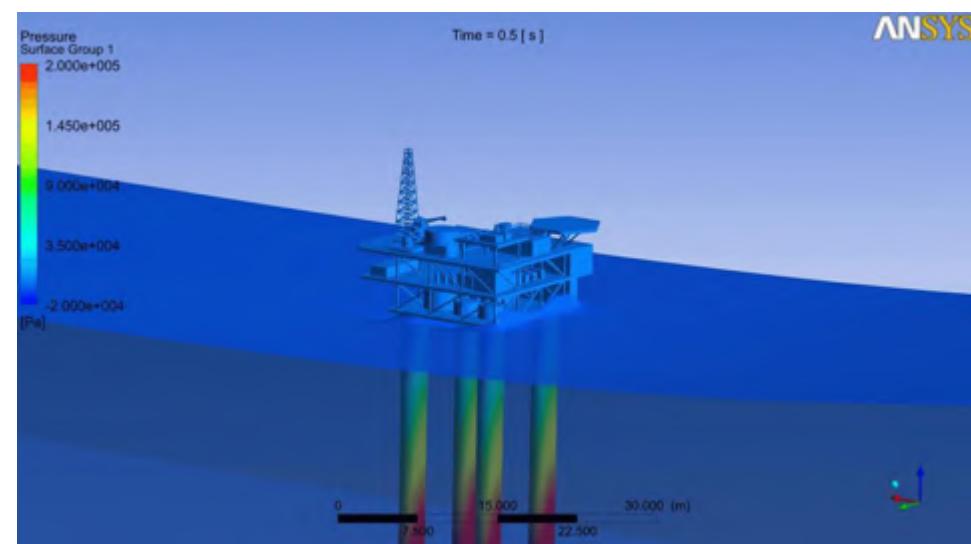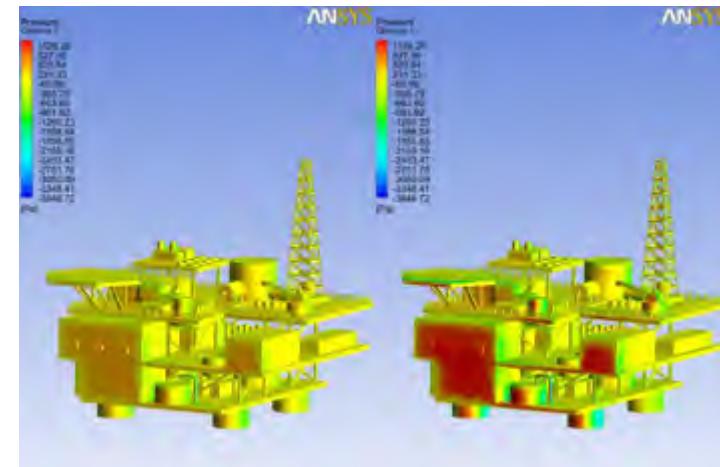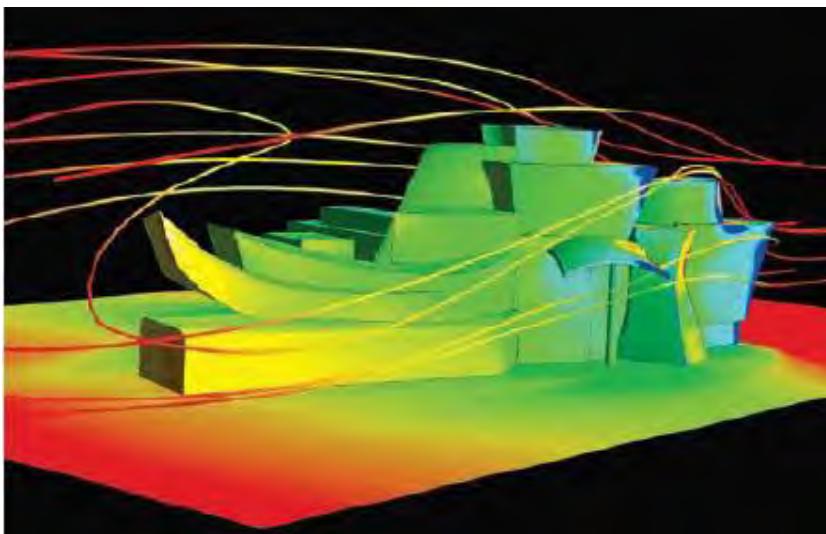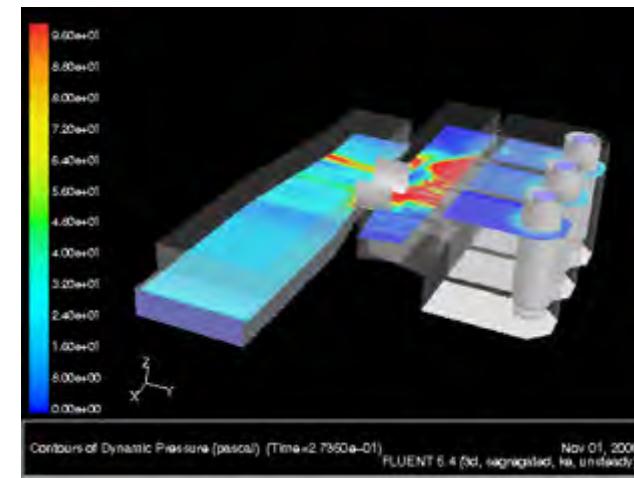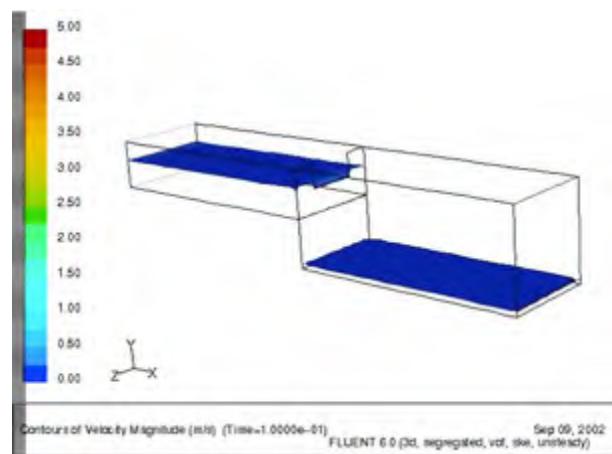
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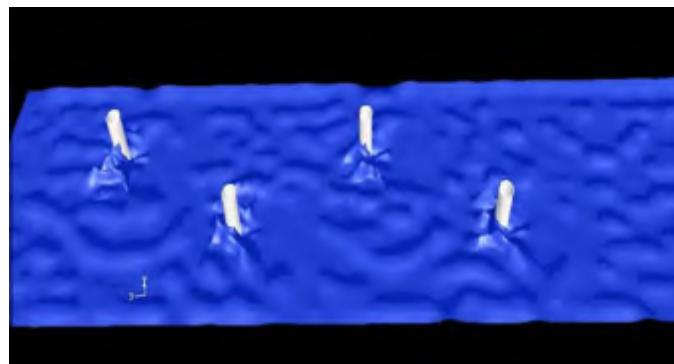
Pump Station

Scouring
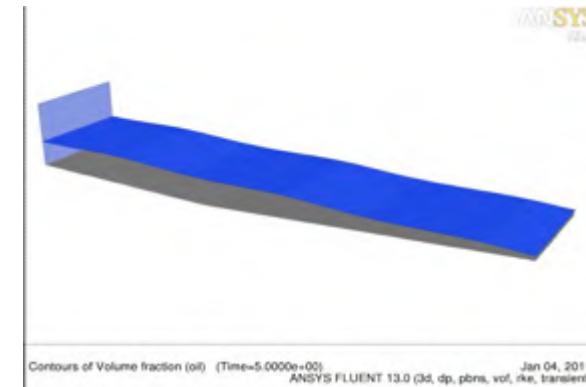
Oil Spilling

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街区风道
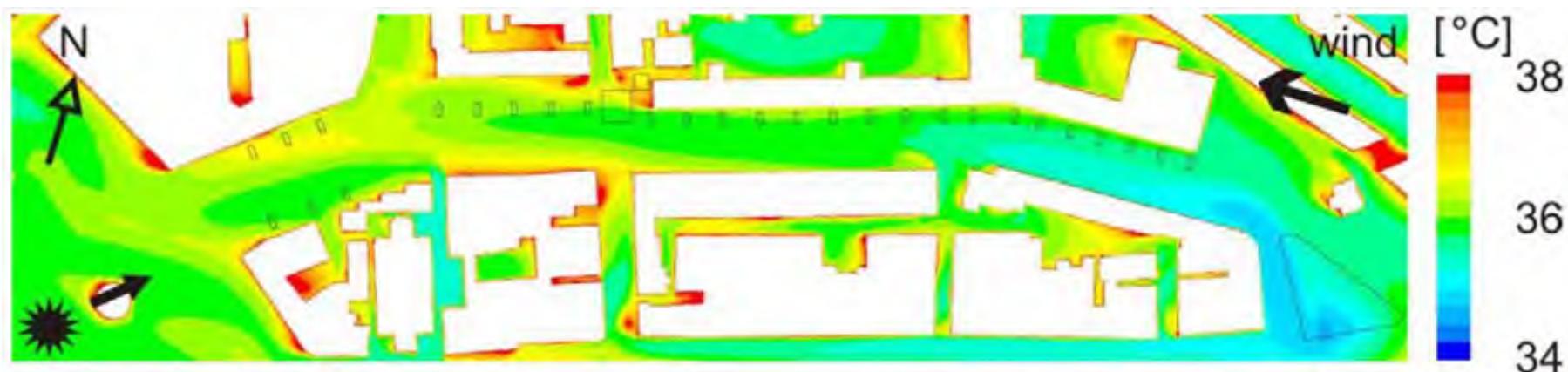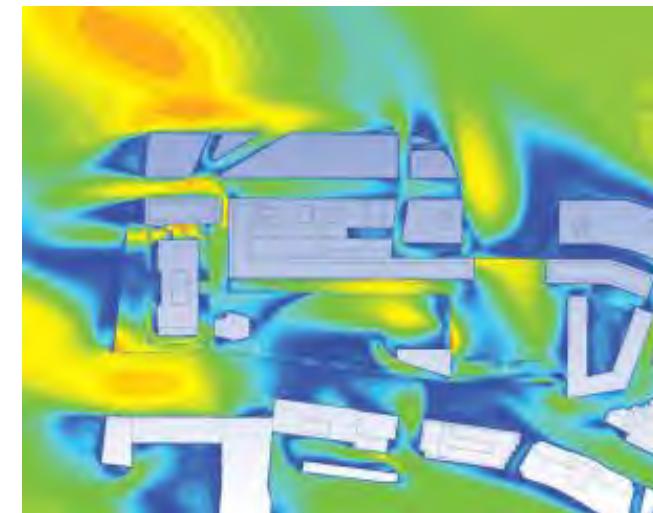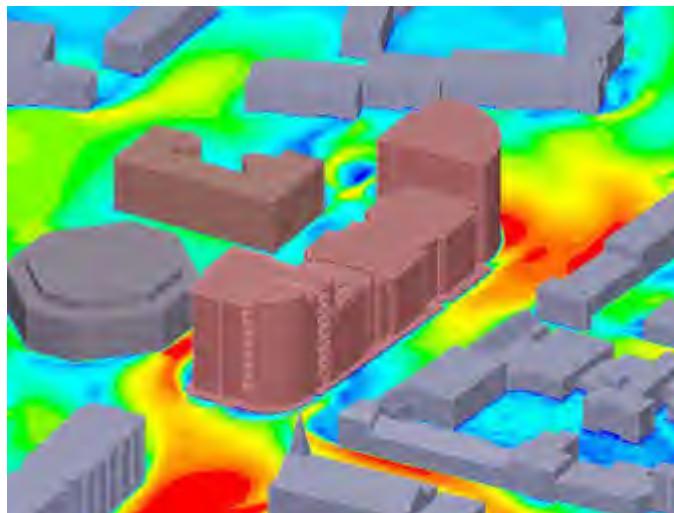
烟气扩散
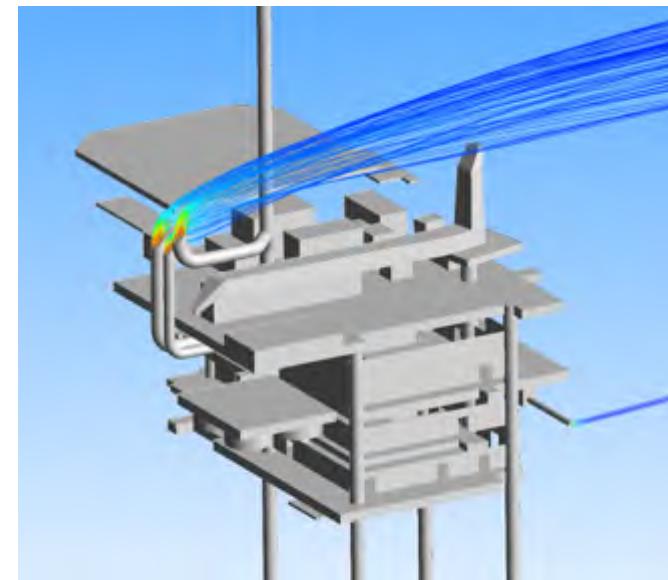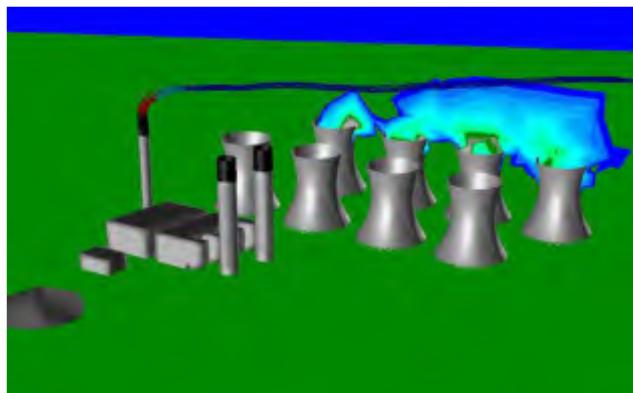
World Trade Center Collapse

流固耦合

ANSYS多物理仿真

Fluid – Structure

Fluid – Structure (Thermal)

Electro – Thermal (Fluid Cooling)

Structural Analysis

Fluid Flow Analysis

Low and High Frequency Electromagnetics

Electro – Thermal – Structure

External Data

Multiphysics Methods:
Single Solver Architecture
Data Transfer
One-Way Coupling
Two-Way Co-Simulation
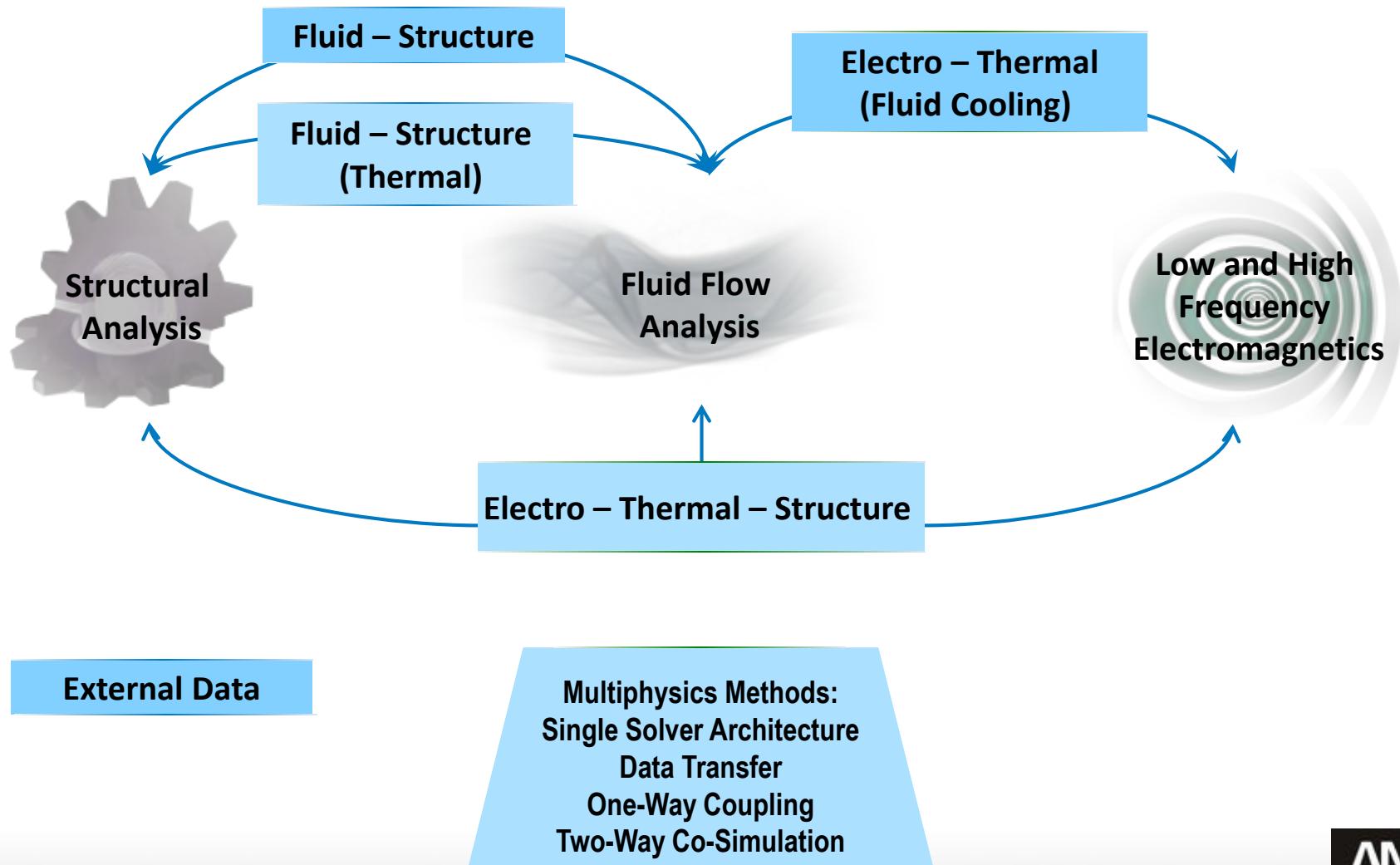
FSI Workflows
Physical **Modeling Approaches**
Coupling

Very Strong — Biomedical, membranes, highly deformable solids, …

Vortex induced vibrations, …

Strong — Blade deformations, rigid bodies, …

Weak — CHT, small deformations (excluding turbulence induced), …

Numerical Coupling

1-way (uncoupled) | *2-way*

Explicit | *Implicit*

Iterative

Fully Coupled

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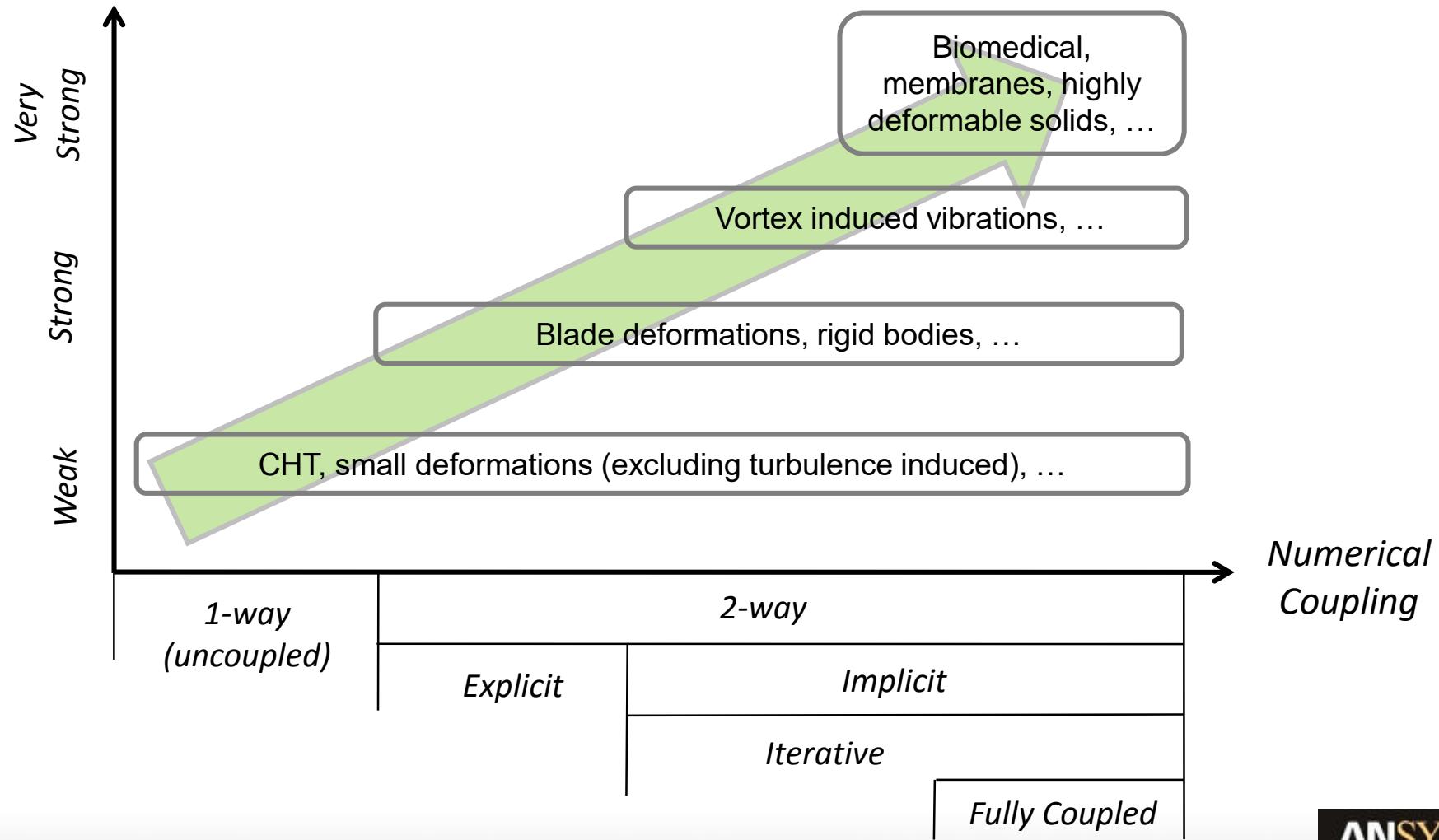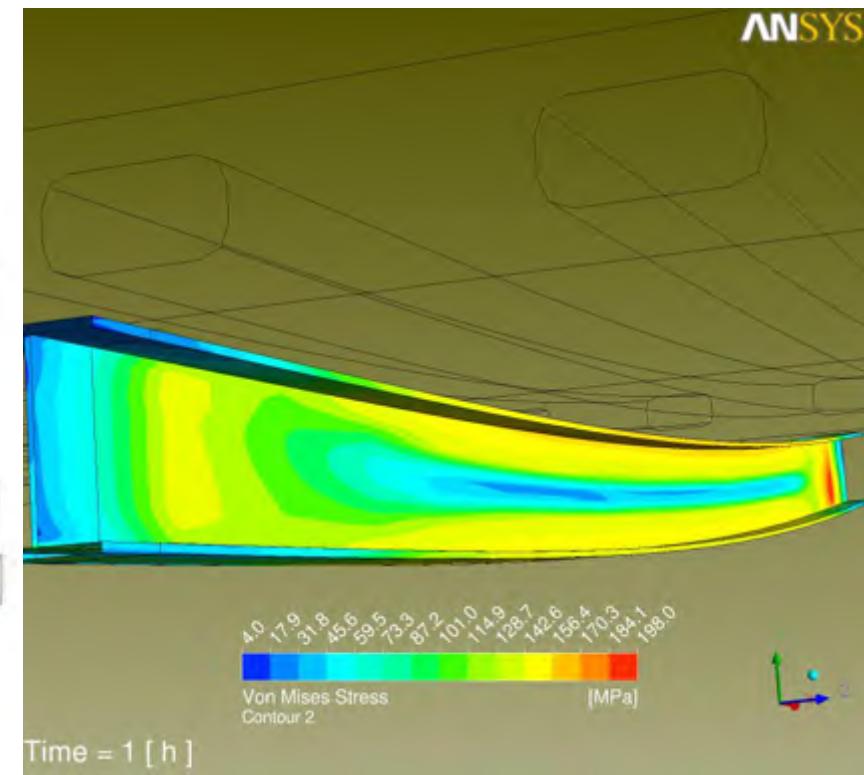
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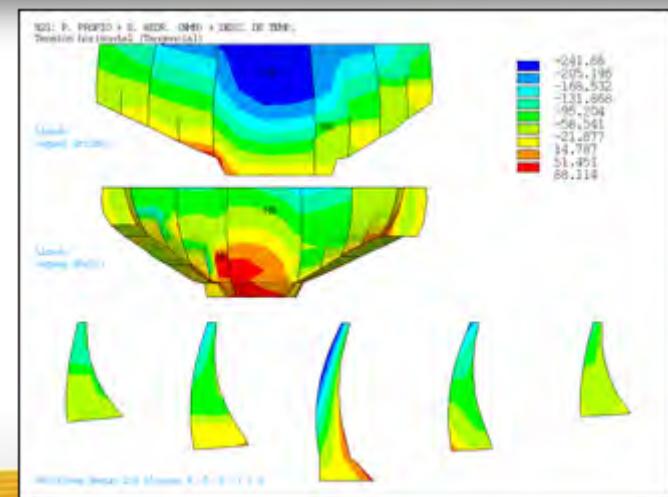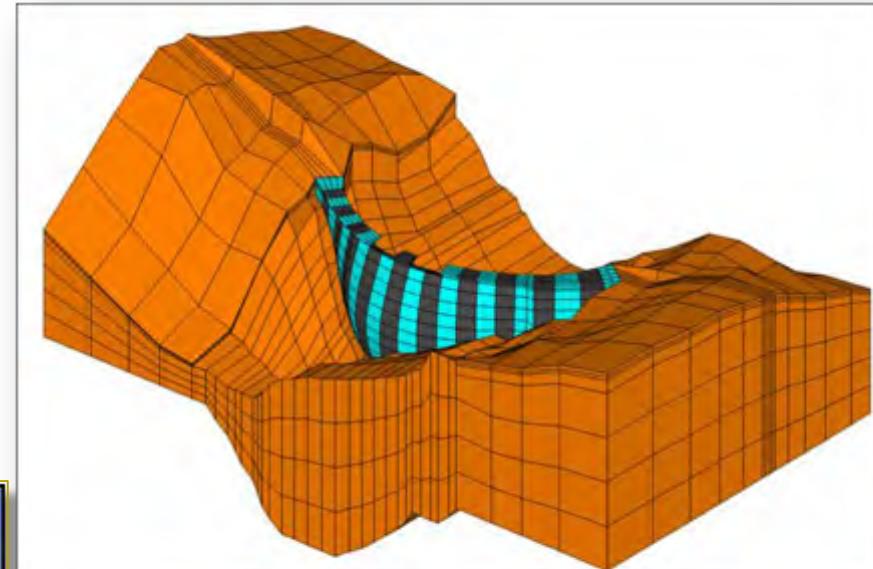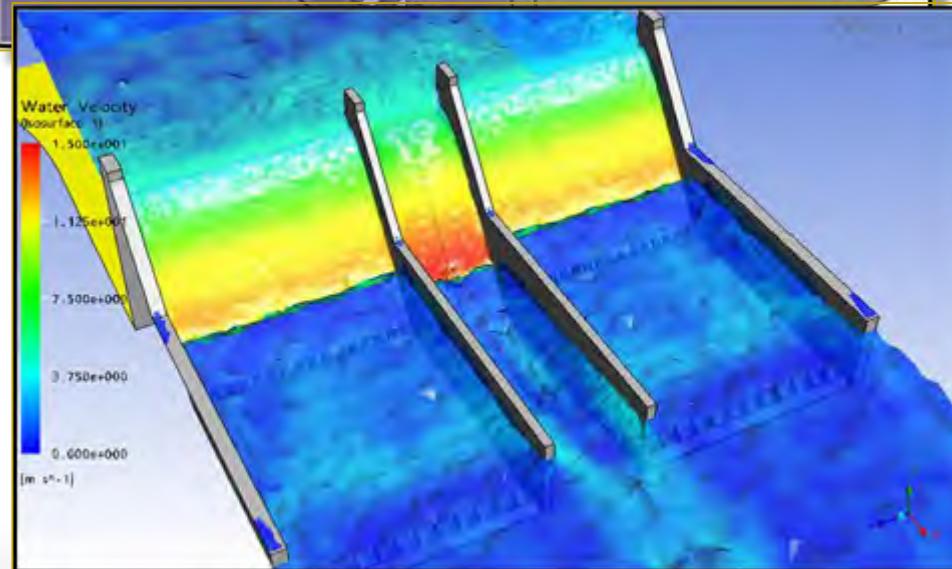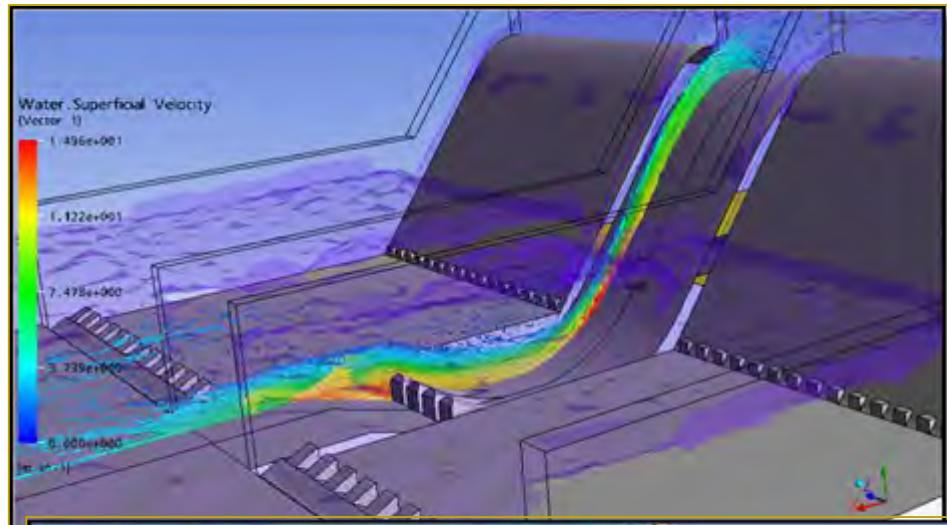
Dam: Fluid + Structural Analysis
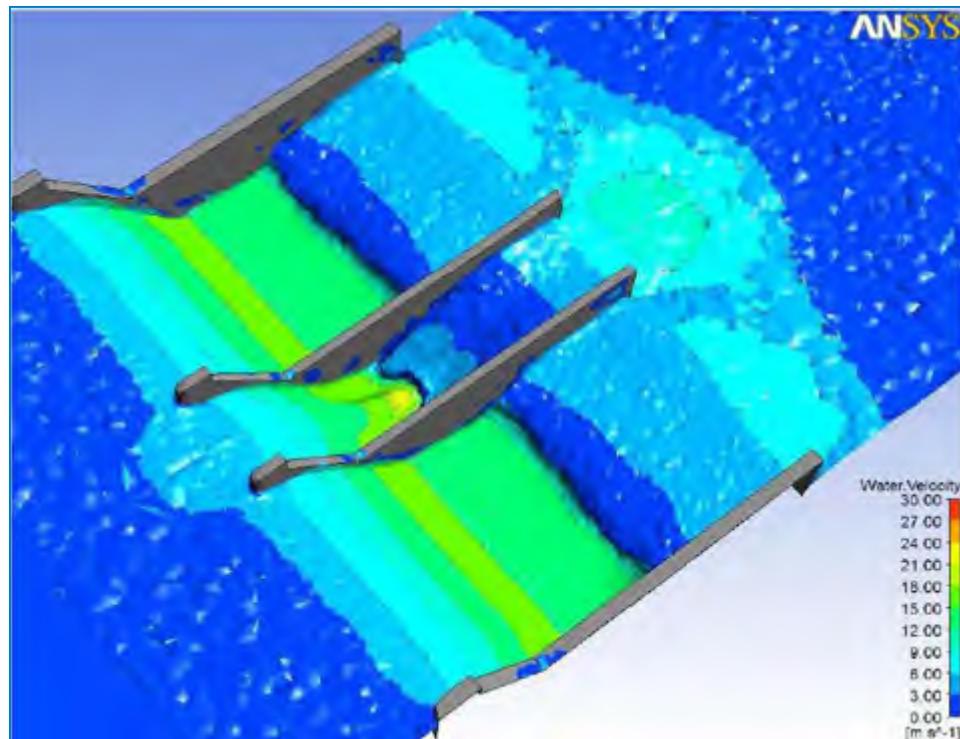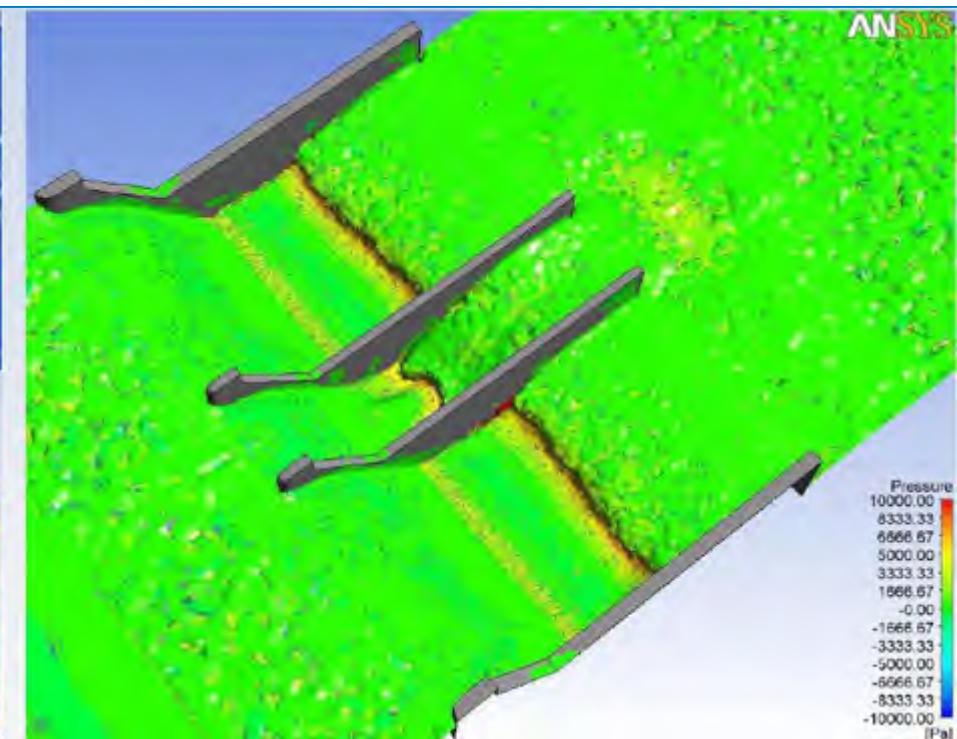
## Water Velocity   Pressure

Dam: Fluid + Structural Analysis
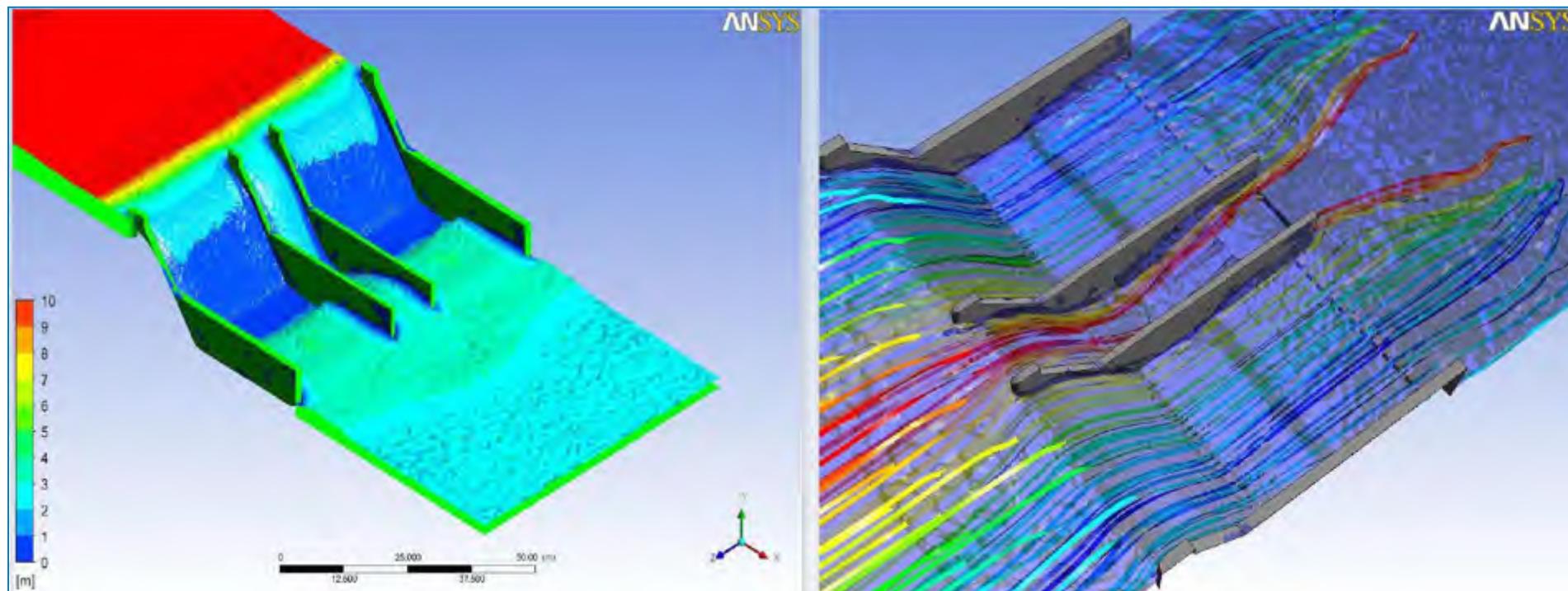
Fluid Elevation

Streamlines

感谢聆听