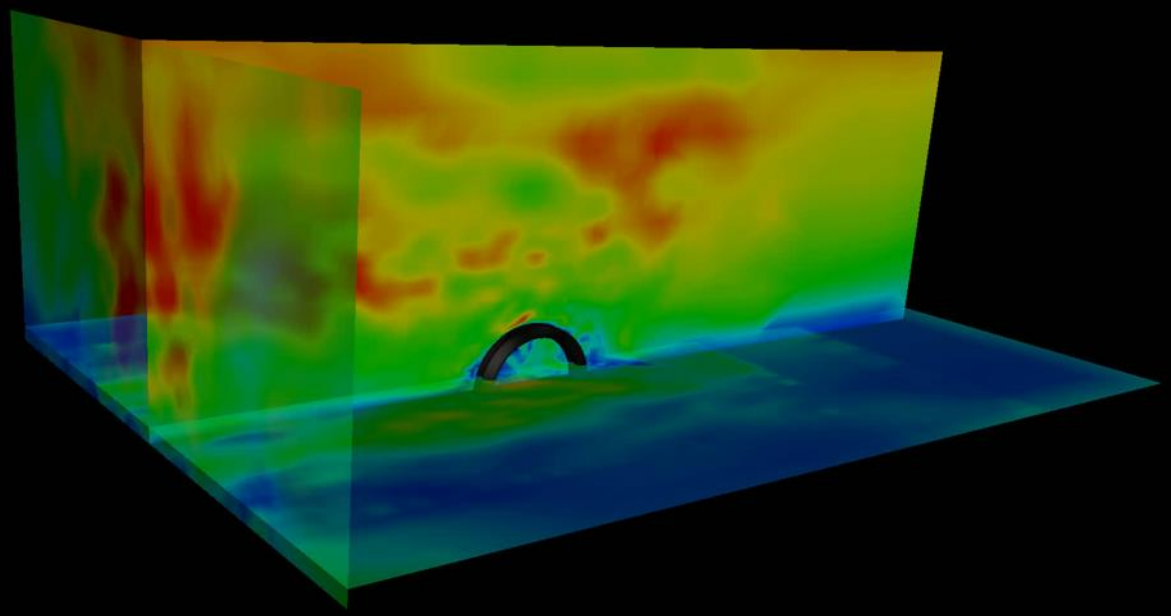
Chair of Structural Analysis
TUM Department of Civil, Geo and Environmental Engineering
Technical University of Munich



STRUCTURAL WIND ENGINEERING

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Presentation material from internal and external sources have been used either directly, modified or adapted to fit the purpose. Effort is continuously being made to accurately reference these. Nonetheless, check referencing in both the script as well as slides for completeness. In case of inconsistencies or mistakes please contact us!

Kratos 2D Fluid Tutorial to an MDoF CSD System

In this tutorial we will investigate how to do a structural simulation using GID and Kratos. We will be using the geometry of structure from Tutorial 4.

Covered topics:

- Predefined example for structural simulation (aim of the current lecture, do not forget to do the necessary modifications in the setup parameters)

- **Or:** Preprocessing (out of scope for the current lecture)

  Geometry
  Input data and conditions

- Postprocessing of results

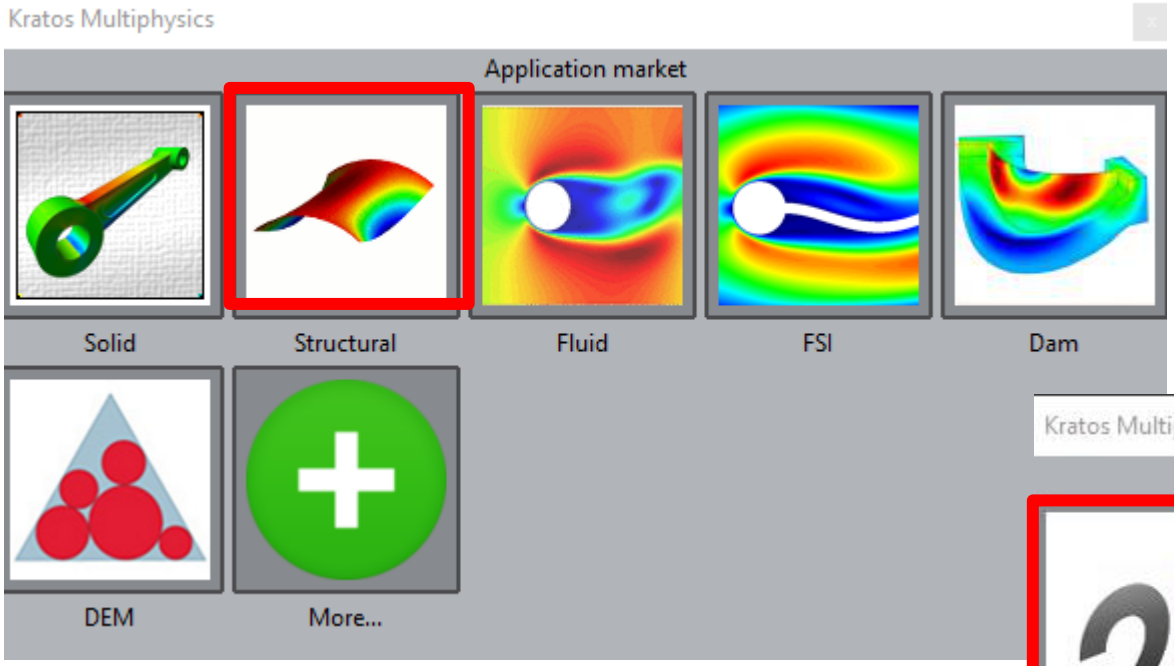
Disclaimer: This example serves the sole educational purpose of demonstrating how to setup a basic 2D CSD problem, run the simulation and do some postprocessing. For any real case in wind engineering a 3D setup should be adopted accompanied with detailed mesh and time step study.

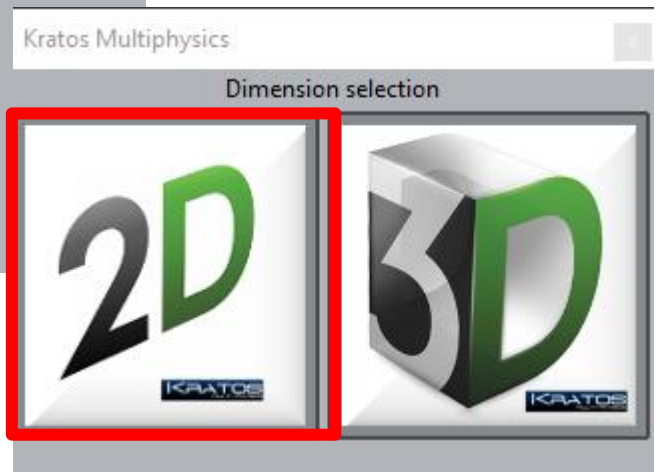
Technical note: Tested on 14.12.2020, works with GiD 15.0.1 and the Kratos problemtype (8.1) on Windows 10 and Ubuntu 18/20 64 bit

Note: This set up will be used later for FSI simulation of a building.

Problem type

- Load the Kratos problem type
  Data → Problem type → Kratos
- Select *Structural* in the first window (Application Type) and click the *Next* button
- Select *2D* in the second window (Analysis Type) and click the *Next* button

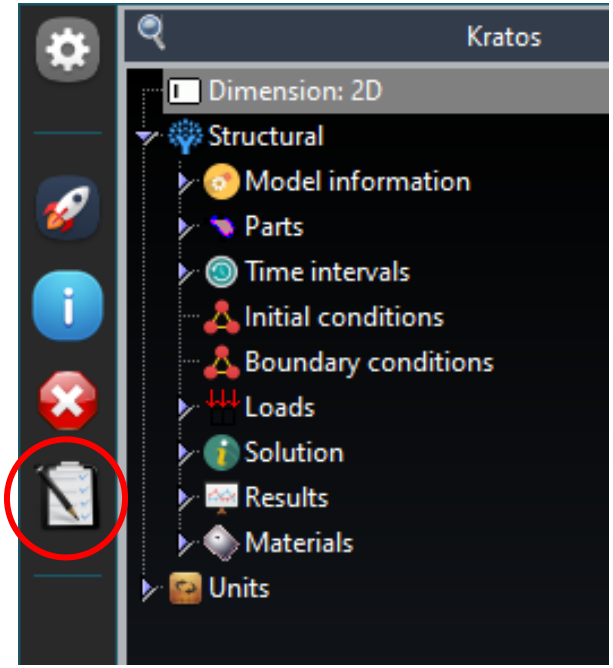




Use of the predefined example

Predefined example „High-rise building“

- Load the predefined example “High-rise building 2D”



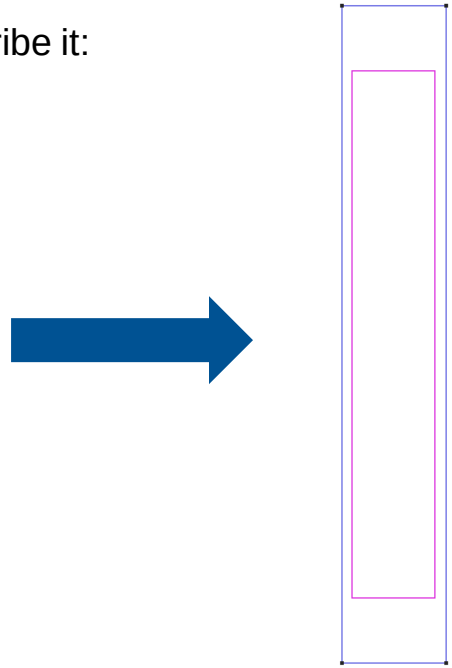
- Continue on page 10 → Check the time and solver settings
- Generate the mesh
- Run the calculation

Defining the Geometry

Geometry

- Create the geometry in the XY-plane using the following points to describe it:

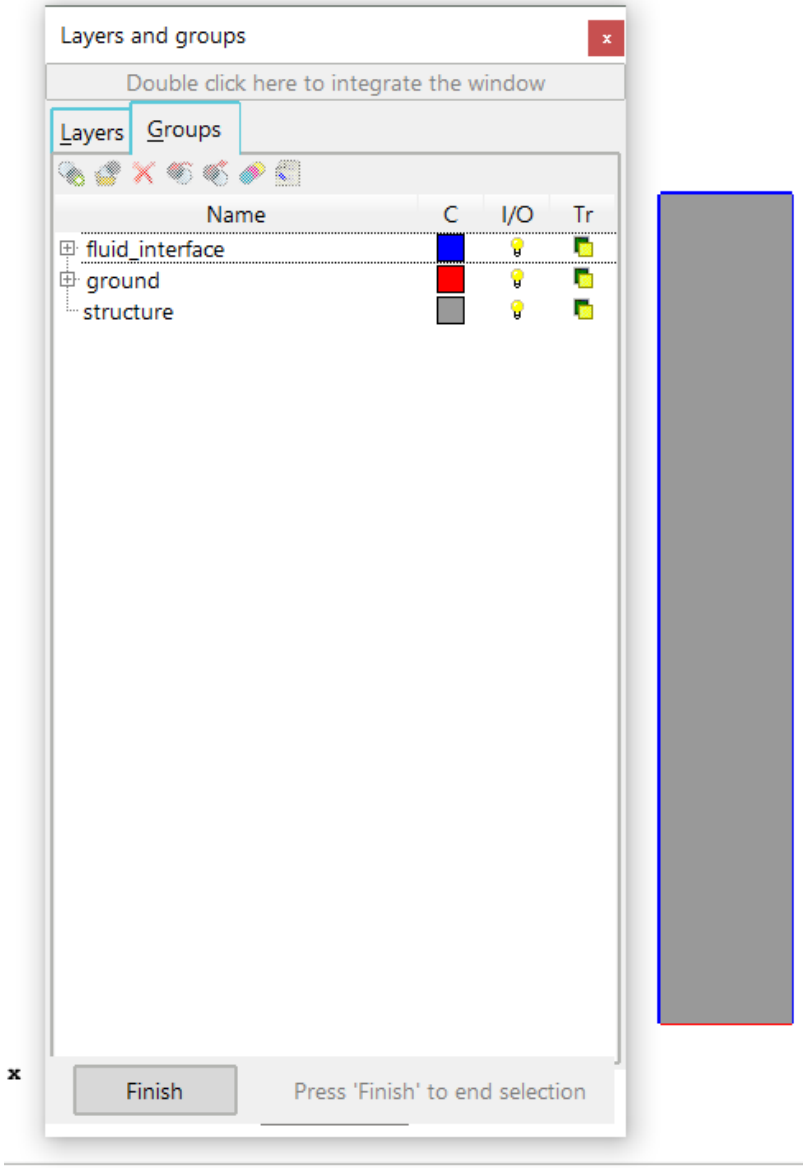
Structure X	Y	Z
15.0	0.0	0.0
15.0	190.0	0.0
-15.0	0.0	0.0
-15.0	190.0	0.0



- Create the points first, followed by the lines and the surface.

Define the entry groups

- *structure* group
  - Select surface
- *ground* group
  - Select bottom line
- *fluid_interface* group
  - Select the remaining lines

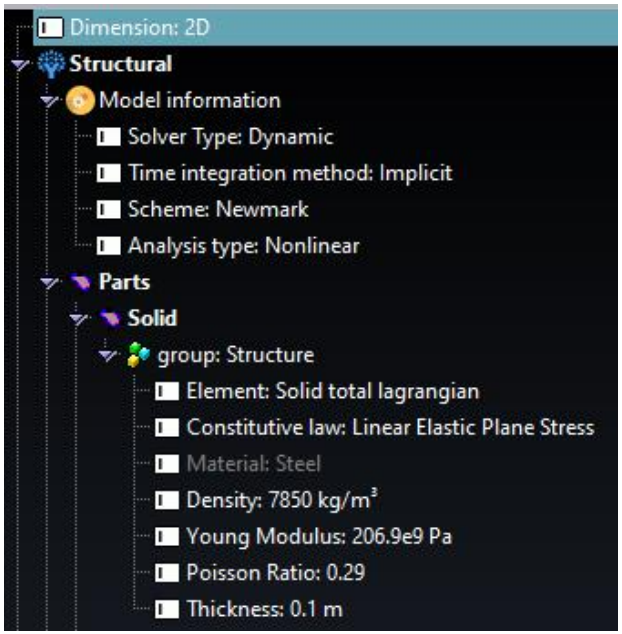


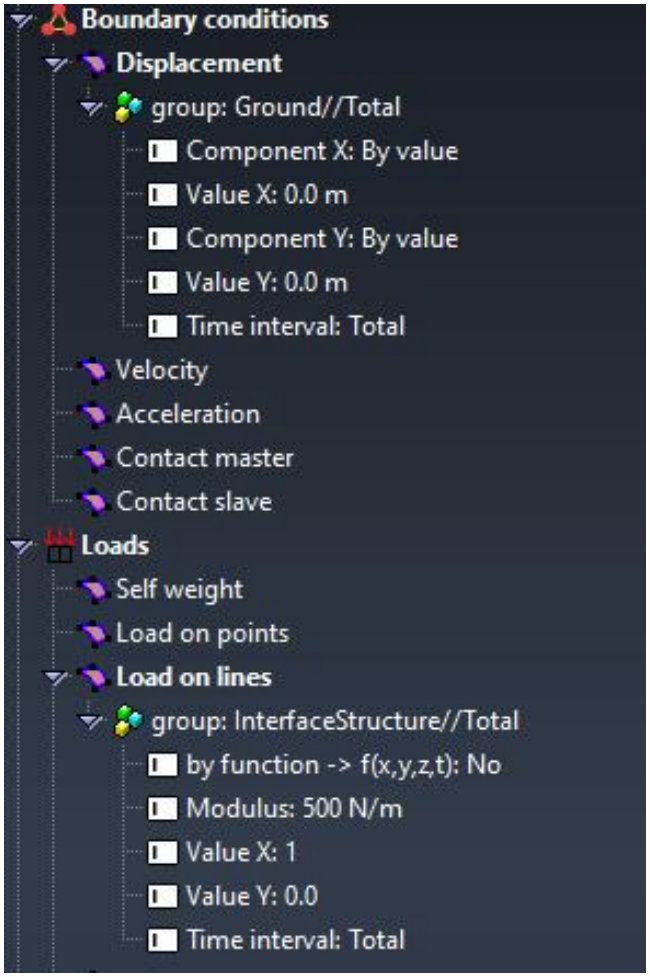
Problem Input

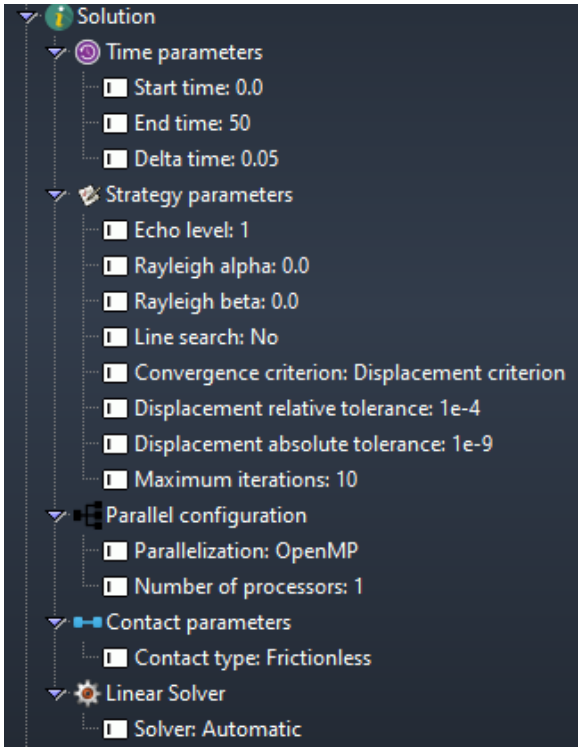
Model properties and boundary conditions (1)

- Assign the group *structure* to the *Parts - Solid* and choose on *Surfaces*
- Specify the property of steel.
  - Density : 7850 kg/m^3
  - Young‘s Modulus : 206.9 e9 Pa
  - Poisson Ratio: 0.29
  - Thickness: 0.1 m
- Use the *Solid* *total lagrangian element* with *Linear elastic Plane stress*
- Apply fixed boundary condition at the bottom by setting all the displacement values to 0 and assign this boundary condition to *ground*.
- Appy load boundary condition at the *fluid_interface* by assigning it to *Load on lines* and set the modulus to 500 in direction x.
- Use the *time* and *solver settings* same as in the figure.

Model properties and boundary conditions (2)

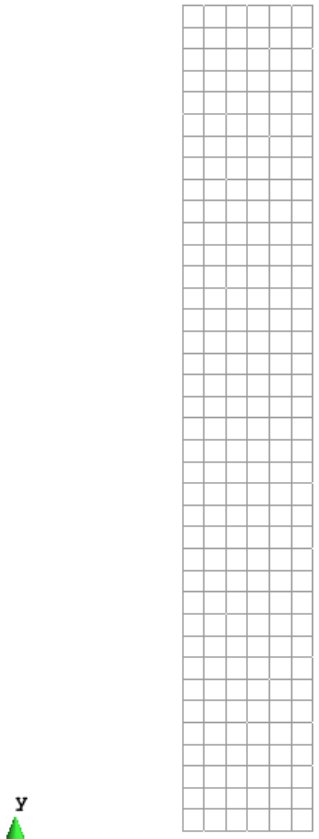






Mesh the domain

- We need to mesh the domain in order to discretize the problem
  Mesh → Structured → Lines → Assign size: use size 5.0
- In the box that appears, set size to 5.0 and click the *Assign* button. Then select all lines of the structure and press *Esc*
- Then assign the same size to the surface
  Mesh → Structured → Surface
- Select the surface and press *Esc*
- *Now generate the mesh by pressing Ctrl+ g.*



Note: Size for the mesh could be chosen as it was used in the Tutorial4_2D. This set up could be later used for performing FSI with **matching grid**. Now assuming 5.0 for a **non-matching grid**.

Solve the problem

- Save your model
  Files → Save
  or *Ctrl + s*

- Launch Kratos with
  Calculate → Calculate
  or *F5*

- The input data will be checked for errors

- The calculation should take a few seconds

Solution Postprocessing

Postprocessing

For viewing deformed shape