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Engineering Office
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Automation in micropile design

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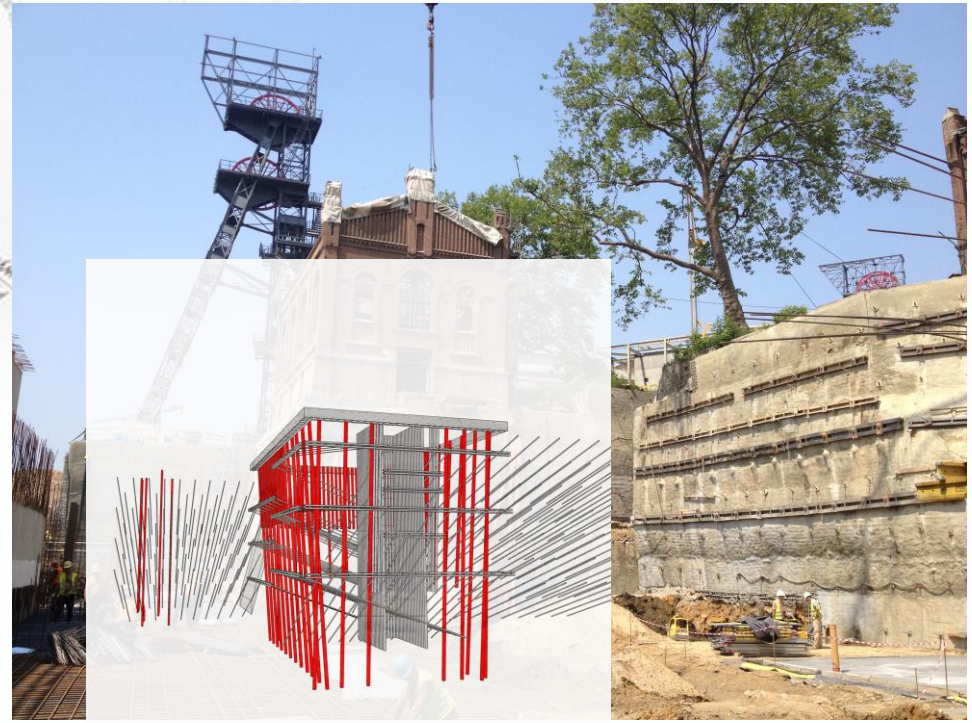
WE ARE PASSIONATE ABOUT **GEOTECHNICS**

Why automate micropile design ?

Why automate micropile design ?

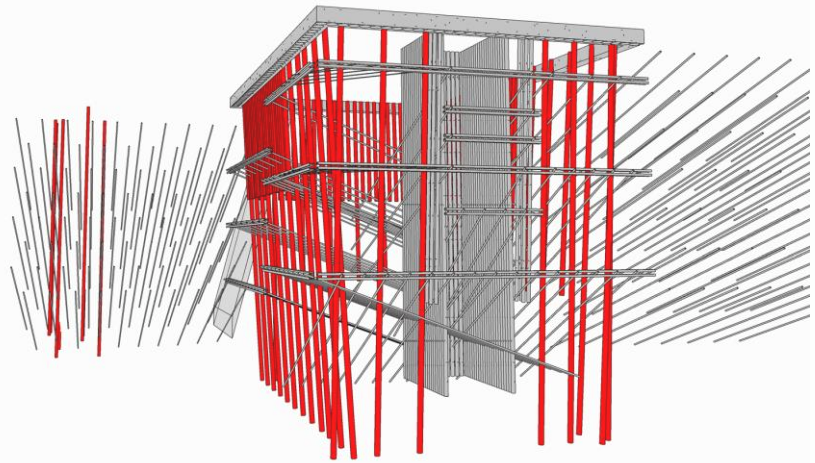
Wide range of possible geometrical configurations of micropiles group



Why automate micropile design ?

Wide range of possible geometrical configurations of micropiles group

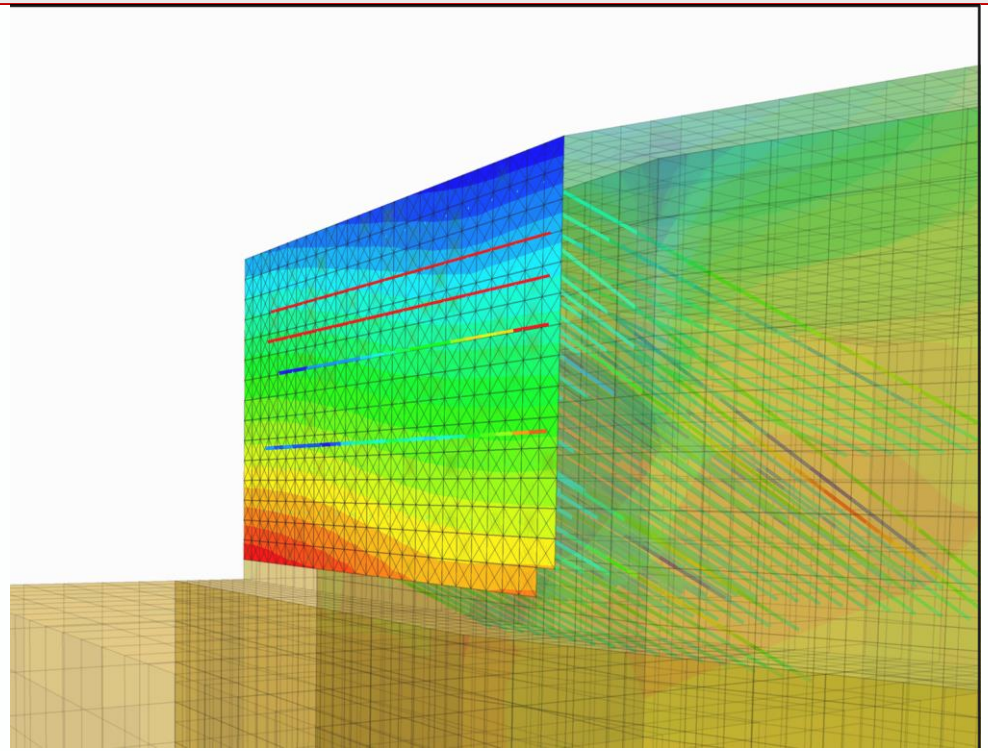
= numerical modeling



Why automate micropile design ?

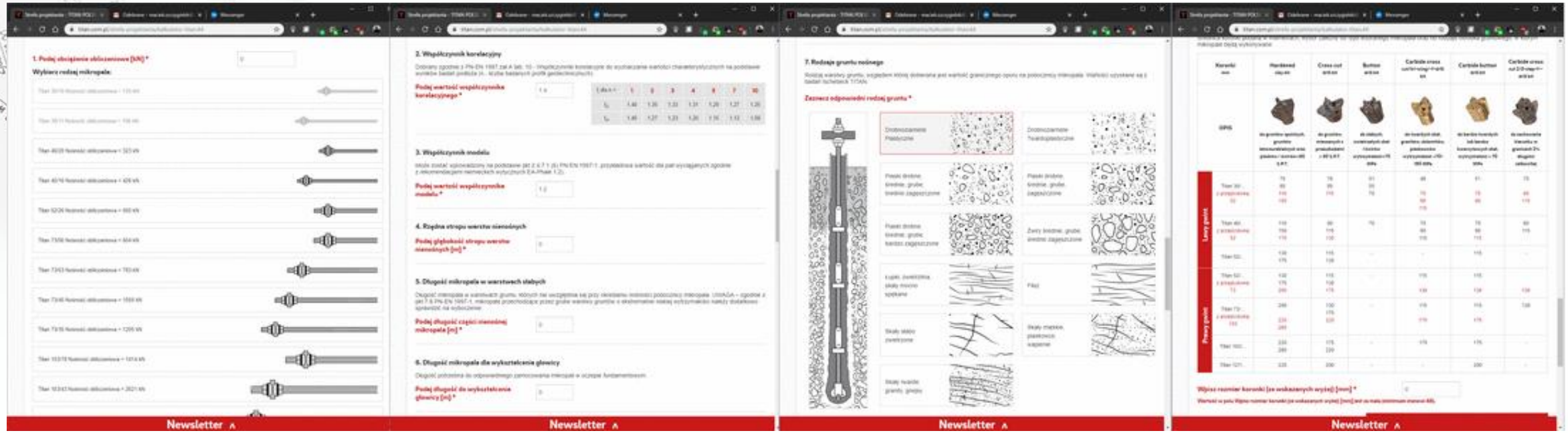
Wide range of possible geometrical configurations of micropiles group

= numerical modeling + scripting



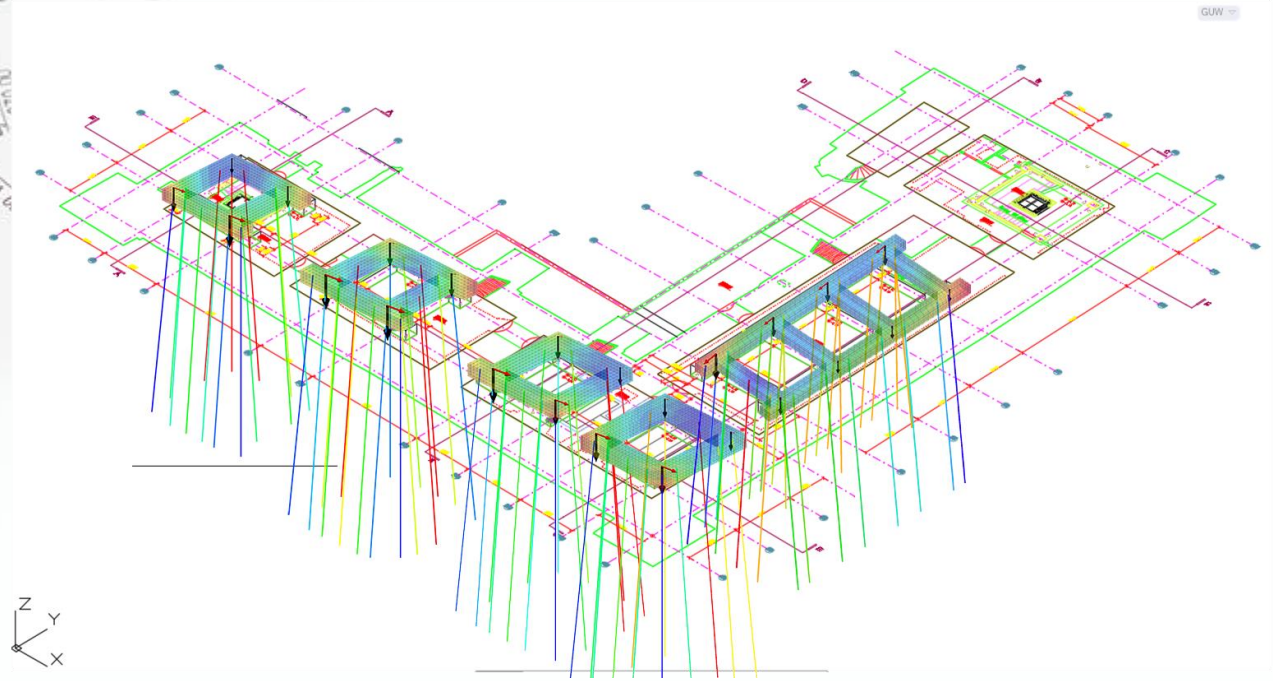
Why automate micropile design ?

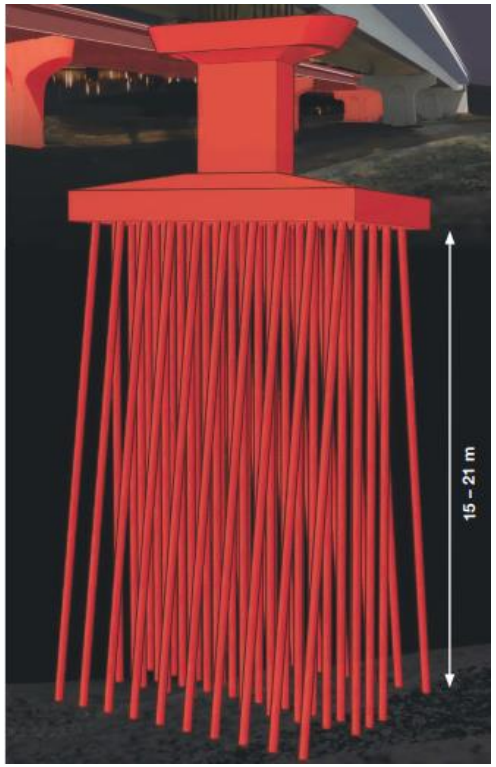
Simple repetable calculation of single pile length from given forces and ground conditions.



Why automate micropile design ?

Optimization – analysis of various design options





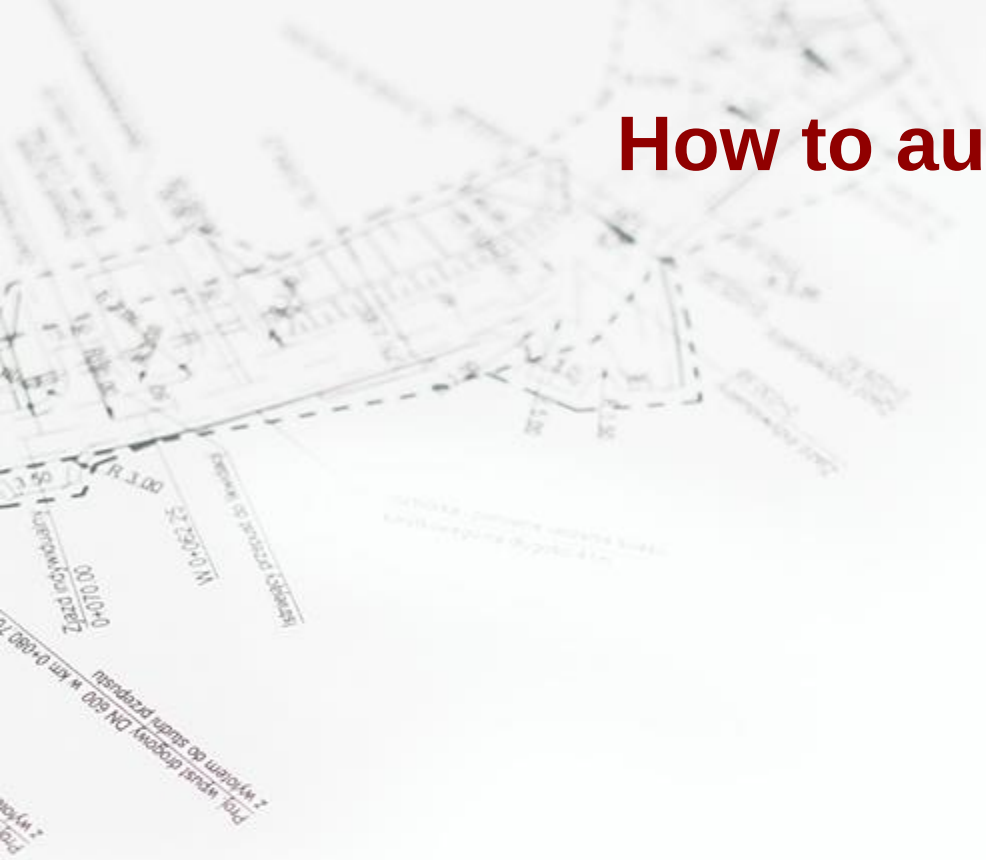
Why automate micropile design ?

Numerical modeling

Simple repetable calculation of single pile length from given forces and ground conditions.

Optimization – analysis of various design options

How to automate micropile design ?



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How to automate micropile design ?

With algorithms !

python™

Library of scripts and commands for micropiles

Library structure

Base objects

- Micropile
- Micropile group

Methods

- In /Out
- Modifying objects
- Generating objects
- Simple calculations

Library structure

OBJECTS

Micropile

Micropile group

Single micropile

LIST

[param1, param2, param3…. param12]

- Geometrical,
- Structural,
- Derived from calculation

Library structure

OBJECTS

Micropile

Micropile group

Micropile group

LIST

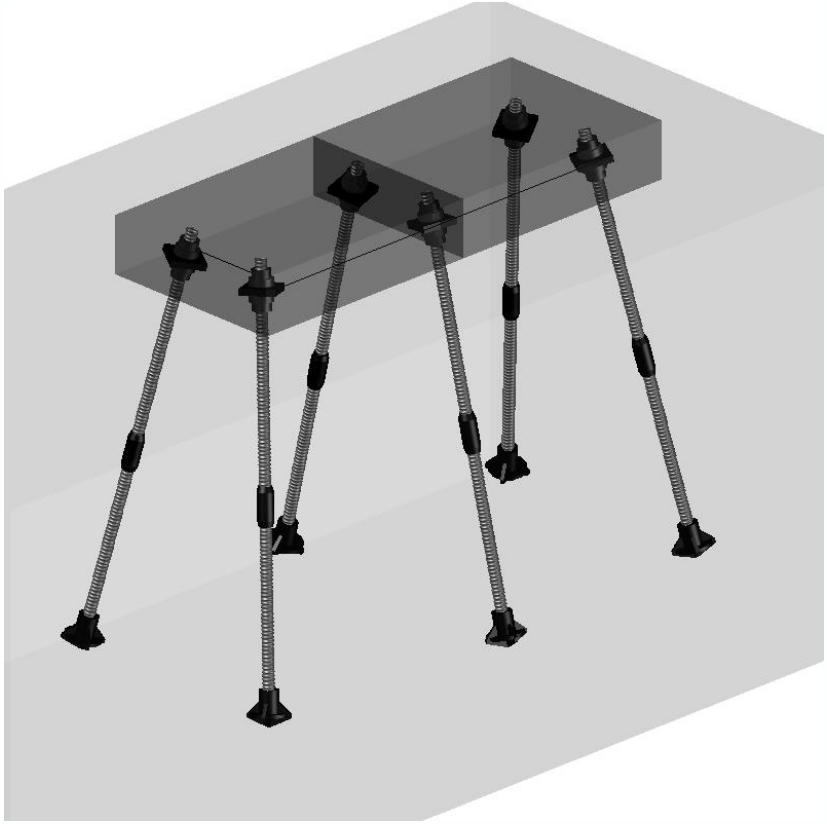
[micropile1,

micropile2,

micropile3,

…

micropileN]



Library structure

METHODS

- Generating
- Modifying
- Simple calculation
- In / Out

Commands used to generate objects i.e. :

gen_one_micropile()

add_to_group(pile)

gen_group_circular()

gen_group_rectangular()

All only with geometrical parameters

Library structure

METHODS

- Generating
- Modifying
- Simple calculation
- In / Out

Commands used to modyfy objects parameters i.e. :

mod_[param](value, pile)

add_to_[param](value, pile)

Library structure

METHODS

Generating

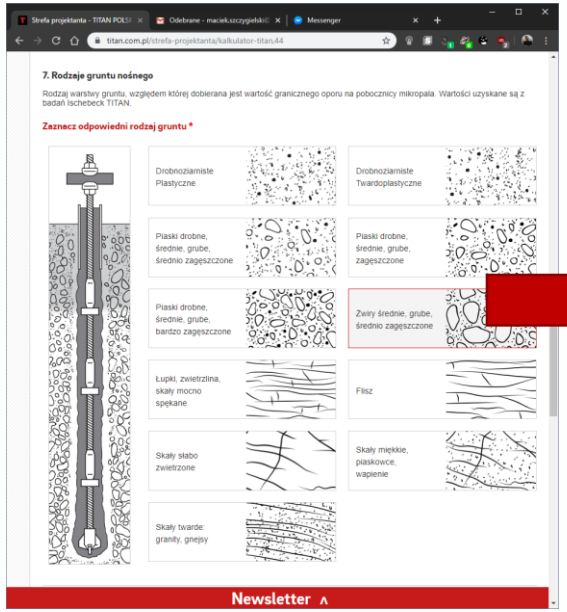
Modifying

Simple calculation

In / Out

Calculating a pile length from:

- Pile forces
- Skin friction table

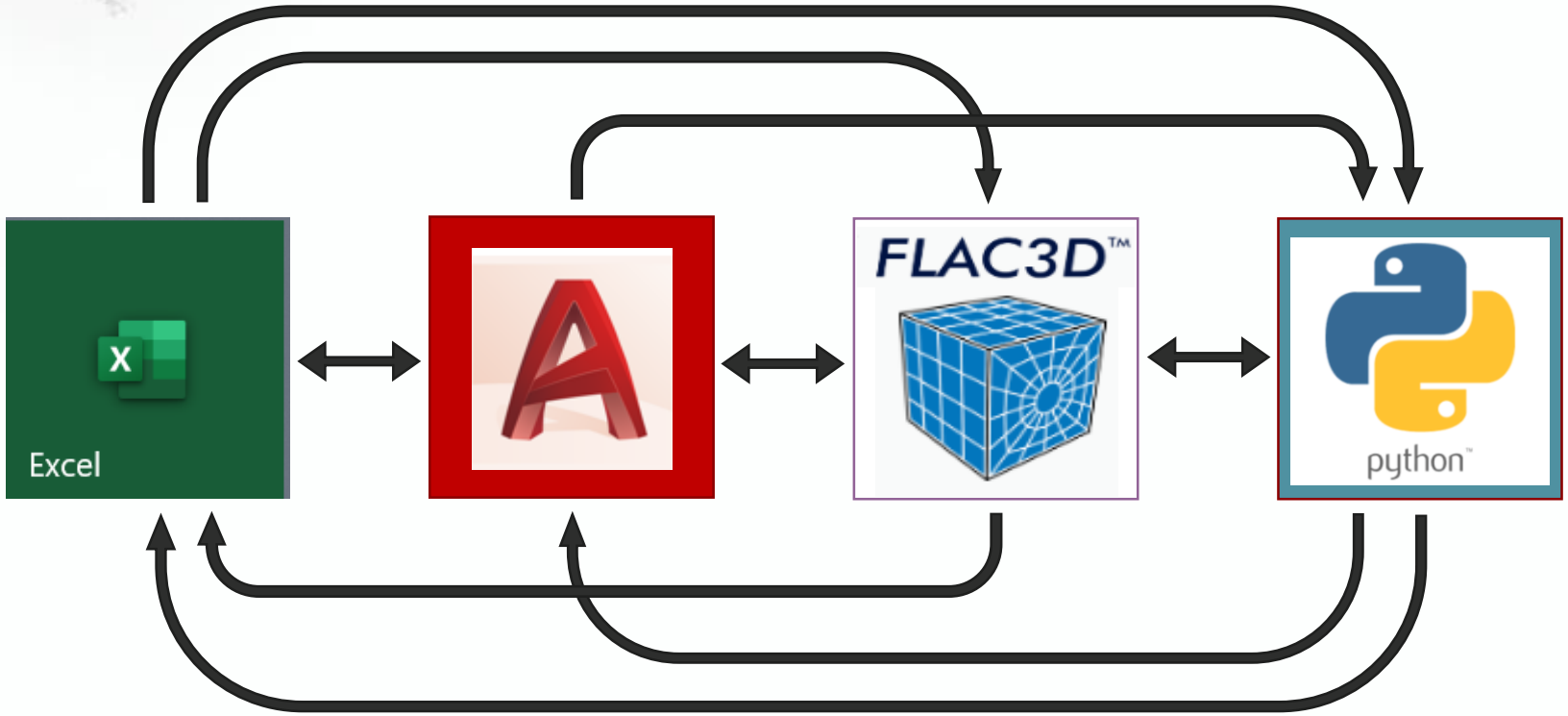



```
def getlenfromtable(pile, soil_params, soil_layers, elem_len_=3.0, ksi_=1.40):
    """Return length of pile for given soil conditions and axial forces """
    axforce = pile[9]
    freelen = pile[12]
    anchorlen = pile[11]
    drilld = pile[8]
    params = ListtoDict(soil_params)
    alphaz = radians(pile[5])

    if axforce >= 0:
        gammas = 1.1
    else:
        gammas = 1.15

    pilelen_range = [elem_len * x for x in range(1, int(36 / elem_len) + 1)]

    for l    in pilelen_range:
        _    = len_ - anchorlen

        =  0
        =  0
        en = 0

    soil_layers[len(soil_layers) - 1][1] = 50.0

    flag = 0
    fl = True

    for elem in soil_layers:

        pileinlay = float(elem[1]) / cos(alphaz)

        # print elem[1], pileinlay
        acclen += pileinlay

        if acclen >= freelen:
            flag += 1
            if flag == 1:
                pileinlay = pileinlay - (acclen - freelen)
```

Library structure

METHODS

- Generating
- Modifying
- Simple calculation
- In / Out



titan.com.pl/python-micropiles

Working on github profile….

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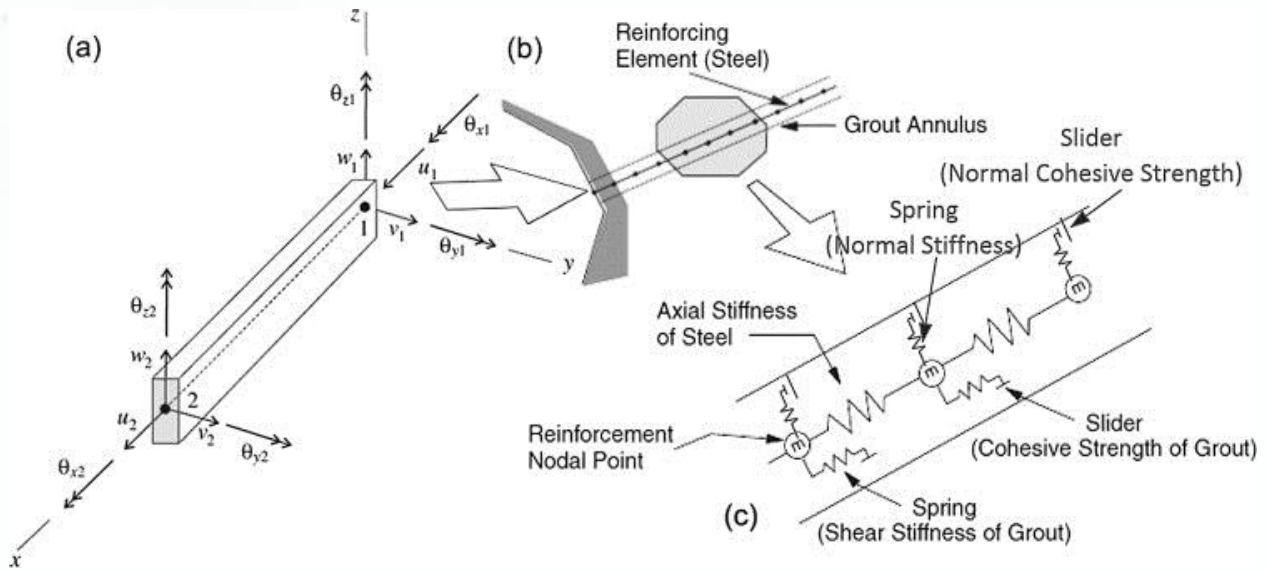
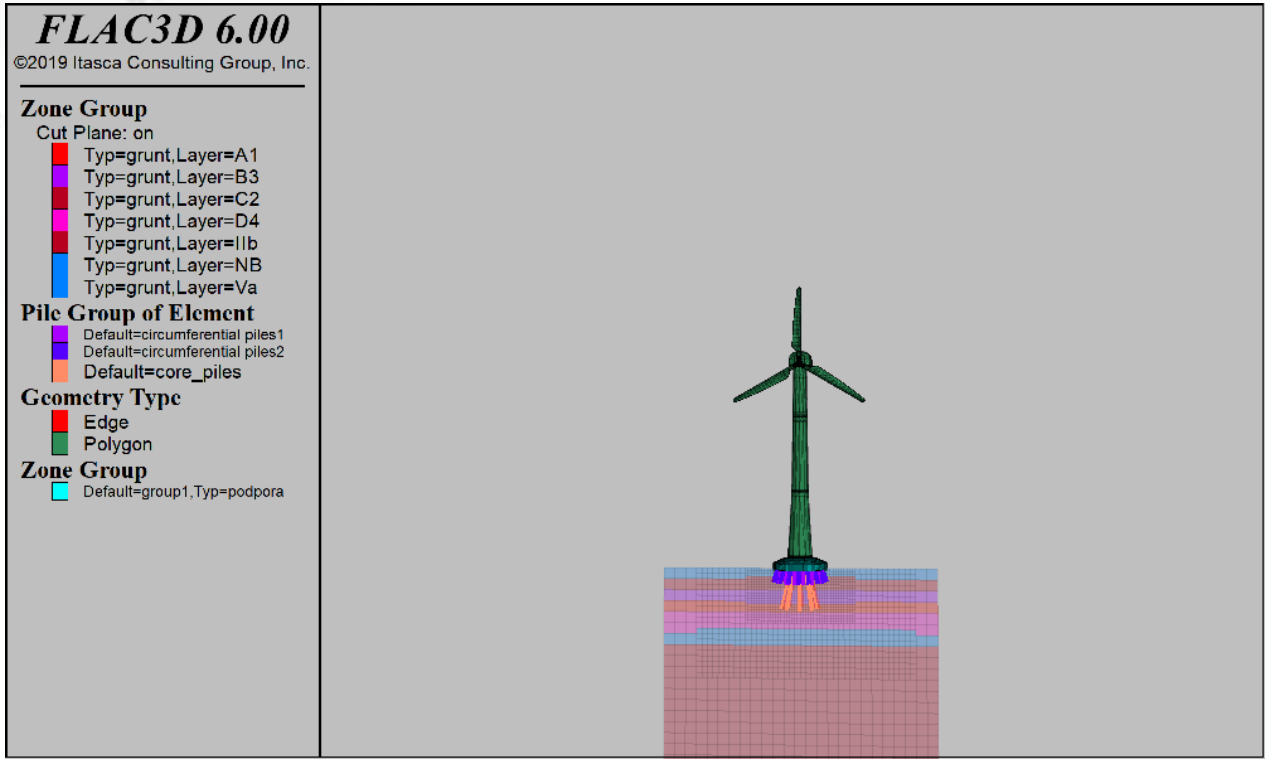
Where to use automation ?

Numerical modeling



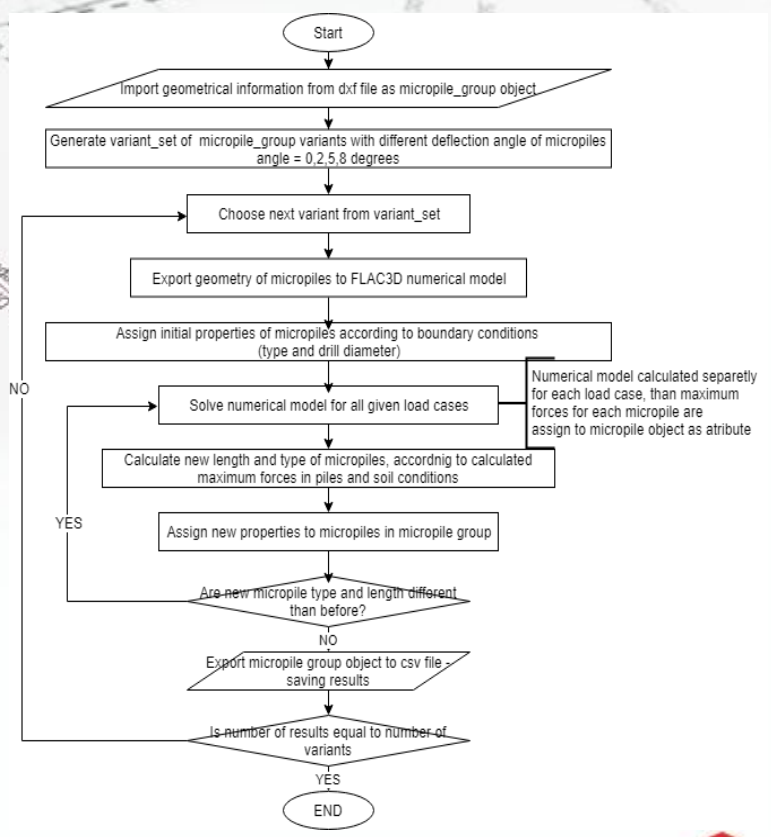
Where to use automation ?

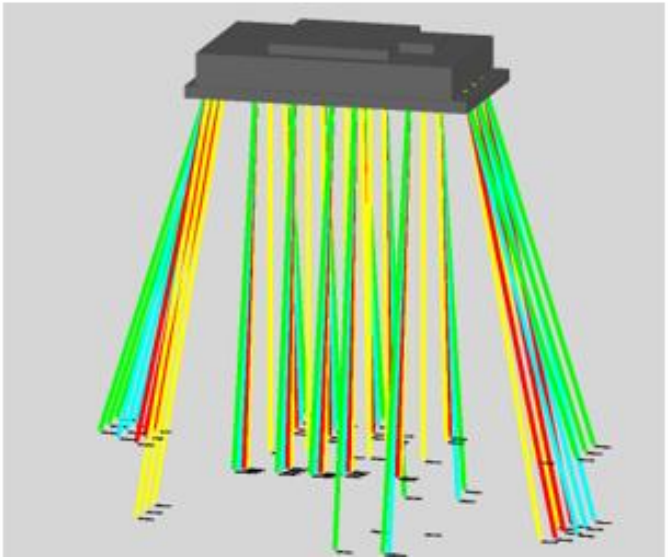
Numerical modeling

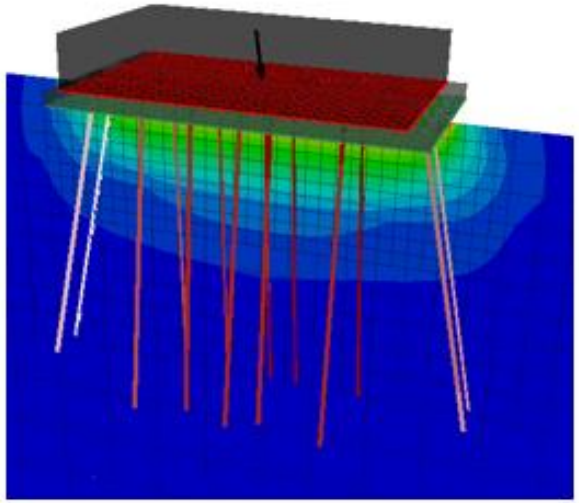


Where to use automation ?

Complex alghoritms





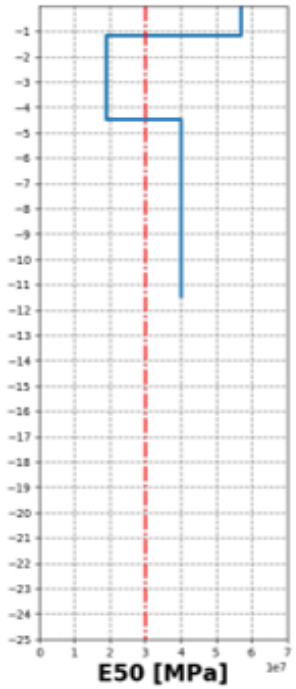


Variant	Micropile type	Length	Micropile type	Length	Total length
Deflection angle 10	TITAN 40/20	330 m	-	-	330 m
Deflection angle 12	**TITAN 40/20**	**324 m**	-	-	**324 m**
Deflection angle 15	TITAN 40/20	330 m	-	-	330 m
Deflection angle 18	TITAN 40/20	240 m	TITAN 40/16	87 m	327

Where to use automation ?

Complex alghoritms

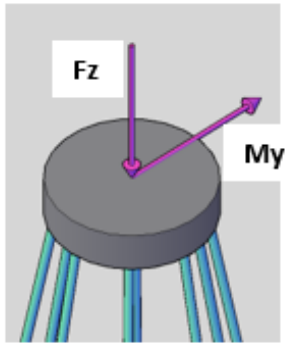
Secant modulus



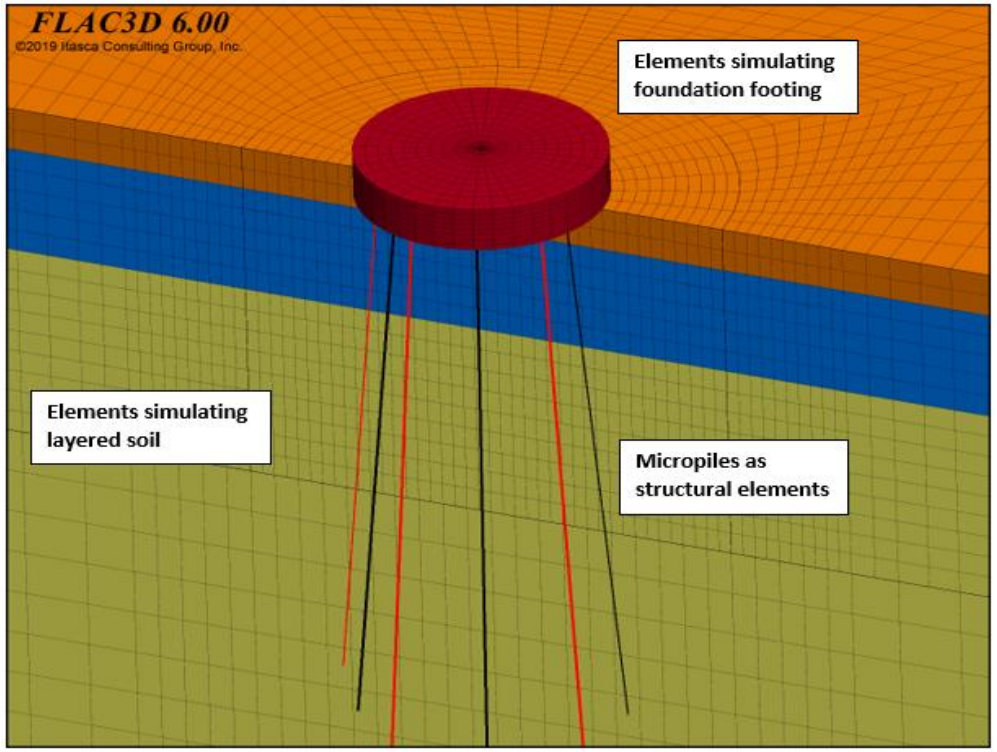
Soil parameters

Layer name	Depth	Density	Cohesion	Friction	Secant modulus E50	qsk
	m	kg/m3	kPa	deg	MPa	kPa
Rp2	1.17	1850	0	39	57	150
Gz2	3.3	2050	10	25	13	50
Gz3	7	2175	12	30	40	100

Loading case

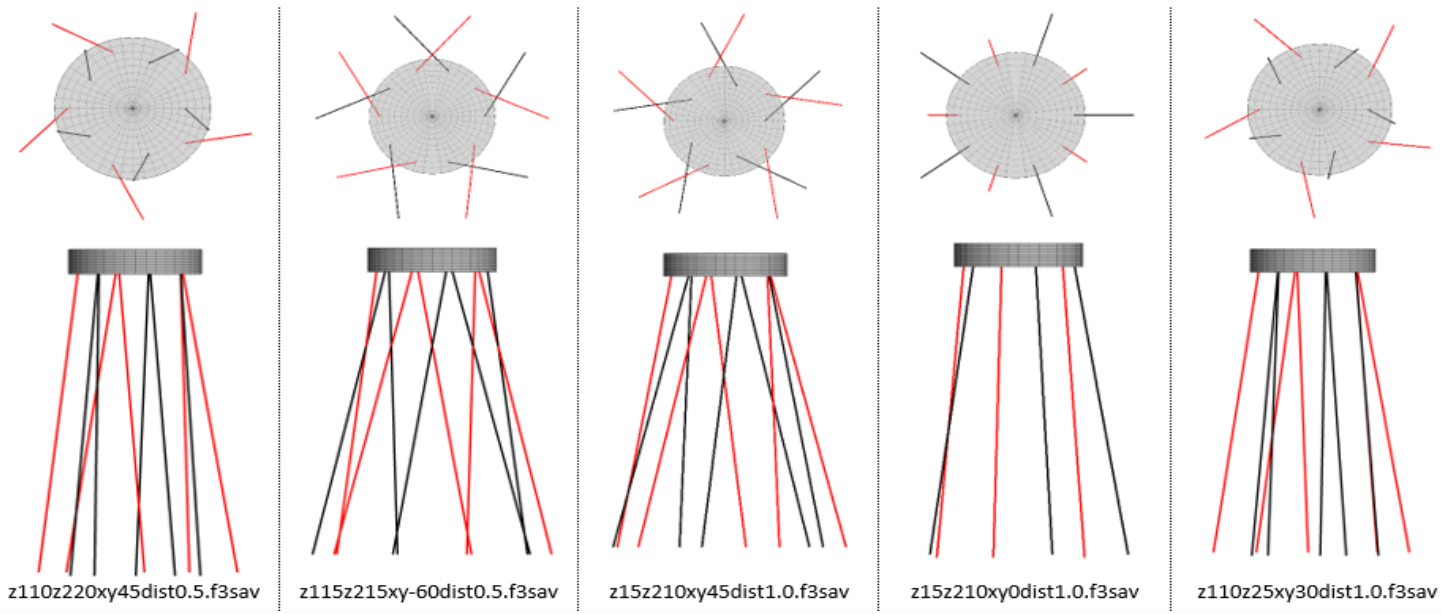


Fz = 0.4 MN
My = 3.68 MN



Where to use automation ?

Complex alghoritms



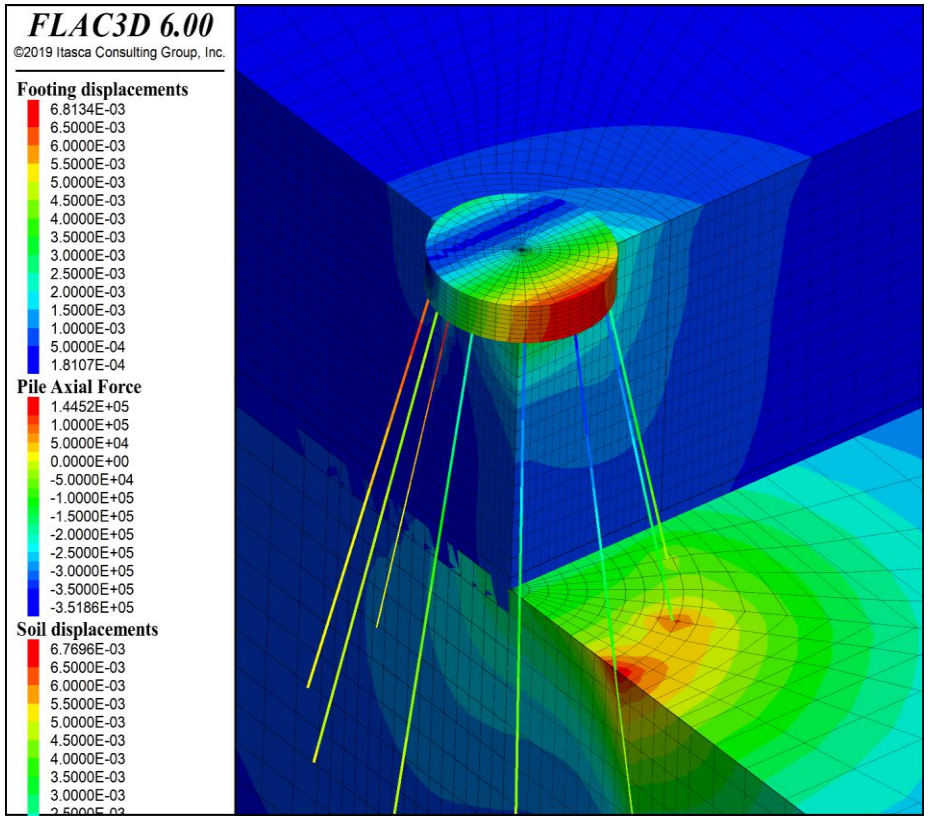
Where to use automation ?

Complex alghoritms

Variant name	Max disp. [mm]	Max Axial Force [kN]
z115z215xy0dist0.5.f3sav	6.54	-351.9
z110z220xy0dist0.5.f3sav	5.96	-374.2
z18z28xy0dist1.0.f3sav	6.62	-374.3
z15z215xy0dist0.5.f3sav	5.79	-374.7
z15z210xy30dist0.5.f3sav	5.56	-375.3
z110z25xy0dist0.5.f3sav	5.72	-377.3
z110z210xy-45dist0.5.f3sav	6.62	-377.8
z110z210xy0dist0.5.f3sav	**6.63**	**-378**
z110z220xy30dist0.5.f3sav	5.84	-380.2
z115z25xy0dist0.5.f3sav	5.78	-380.5
z110z210xy-60dist0.5.f3sav	6.71	-380.5
z15z210xy0dist1.0.f3sav	6.66	-381.4
z15z210xy45dist0.5.f3sav	5.63	-381.7
z15z25xy0dist1.0.f3sav	6.64	-382.1
z110z220xy45dist0.5.f3sav	5.88	-382.9
z15z215xy30dist0.5.f3sav	5.6	-384.3
z115z215xy-45dist0.5.f3sav	6.89	-385.3

Variant name	Max disp. [mm]	Max Axial Force [kN]
z110z25xy0dist1.0.f3sav	6.6	-389.1
z115z215xy-60dist0.5.f3sav	6.77	-389.8
z110z25xy45dist0.5.f3sav	5.62	-390
z110z210xy0dist1.0.f3sav	7.94	-391.5
z115z25xy30dist0.5.f3sav	5.6	-392.2
z110z25xy30dist1.0.f3sav	6.54	-393
z110z25xy30dist0.5.f3sav	5.64	-394.8
z18z28xy30dist1.0.f3sav	6.55	-394.9
z115z25xy45dist0.5.f3sav	5.67	-395.5
z115z215xy0dist1.0.f3sav	8.28	-397.8
z110z210xy30dist1.0.f3sav	6.72	-397.9
z15z210xy0dist0.5.f3sav	5.84	-399.6
z18z28xy45dist1.0.f3sav	6.68	-400.2
z15z25xy30dist1.0.f3sav	6.48	-400.3
z15z215xy45dist0.5.f3sav	5.67	-403.6
z110z25xy45dist1.0.f3sav	6.57	-404.2
z15z25xy45dist1.0.f3sav	6.56	-404.4

Variant name	Max disp. [mm]	Max Axial Force [kN]
z110z210xy-45dist1.0.f3sav	7.8	-405.4
z115z25xy0dist1.0.f3sav	7.07	-407
z15z210xy30dist1.0.f3sav	6.59	-407.8
z110z210xy-60dist1.0.f3sav	7.82	-410.6
z15z215xy0dist1.0.f3sav	7.13	-411.6
z15z210xy45dist1.0.f3sav	6.67	-412.7
z110z210xy45dist1.0.f3sav	6.72	-413.8
z115z215xy-60dist1.0.f3sav	8	-414.6
z110z220xy0dist1.0.f3sav	8.65	-417.2
z115z25xy30dist1.0.f3sav	6.77	-419.2
z115z215xy30dist1.0.f3sav	7.52	-419.7
z115z215xy-45dist1.0.f3sav	8.08	-420.2
z15z215xy30dist1.0.f3sav	6.81	-425
z110z220xy30dist1.0.f3sav	7.26	-425.1
z15z215xy45dist1.0.f3sav	6.95	-433.3
z115z25xy45dist1.0.f3sav	6.8	-441
z115z215xy45dist1.0.f3sav	7.01	-446.3
z110z220xy45dist1.0.f3sav	7.19	-450.9



Summary

Very efficient tool in engineer tolboox

Simple way to exchange data about micropiles between different file types

Extremaly usefull in case of numerical modeling

titan.com.pl/python-micropiles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