
pwptemp

Release 0.3.1

Pro Well Plan AS

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Find here the documentation of pwptemp. Here you will find all the relevant information about any function included in this package.

INSTALLATION

pwptemp is written to be compatible with Python 3+. The best way to install is using pip.

```
$ pip install pwptemp
```

This will make sure that all the dependencies are installed. This requirements are listed below.

1.1 Requirements

- `numpy`
- `torque_drag`
- `scipy`
- `plotly`

TEMPERATURE DURING DRILLING

`pwptemp.calc_temp` (*trajectory*, *casings=None*, *set_inputs=None*, *operation='drilling'*, *time_steps=210*, *smooth=True*, *cells_no=None*)

Function to calculate the well temperature distribution during a specific operation at a certain time.

Parameters

- **trajectory** – wellbore trajectory excellcsvdataframelist
- **casings** – list of dictionaries with casings characteristics (od, id and depth)
- **set_inputs** – dictionary with parameters to set.
- **operation** – define operation type. ('drilling', 'circulating')
- **time_steps** – number of time steps to run calculations.
- **smooth** – smooth the temperature profiles.
- **cells_no** – (int) number of cells. If None -> keep same number of cells than trajectory

Returns Well temperature distribution object

`pwptemp.temperature_behavior` (*well*)

Function to simulate the temperature behavior.

Parameters *well* (*obj*) – well temperature distribution object

Returns temperature behavior object

2.1 Example

```
>>> import pwptemp as pt
>>> import well_profile as wp

>>> trajectory = wp.load('trajectory1.xlsx', equidistant=True)      # using well_
↳profile to load a trajectory

>>> casings = [{'od': 12, 'id': 11, 'depth': 1200},                # creating 3 casings with_
↳respective parameters
>>>             {'od': 10, 'id': 9, 'depth': 1500},                # diameter [in] and depth [m]
>>>             {'od': 8, 'id': 7, 'depth': 2400}]

>>> rop_list = [50, 45, 40, 35]      # setting respective ROP [m/h] for each section

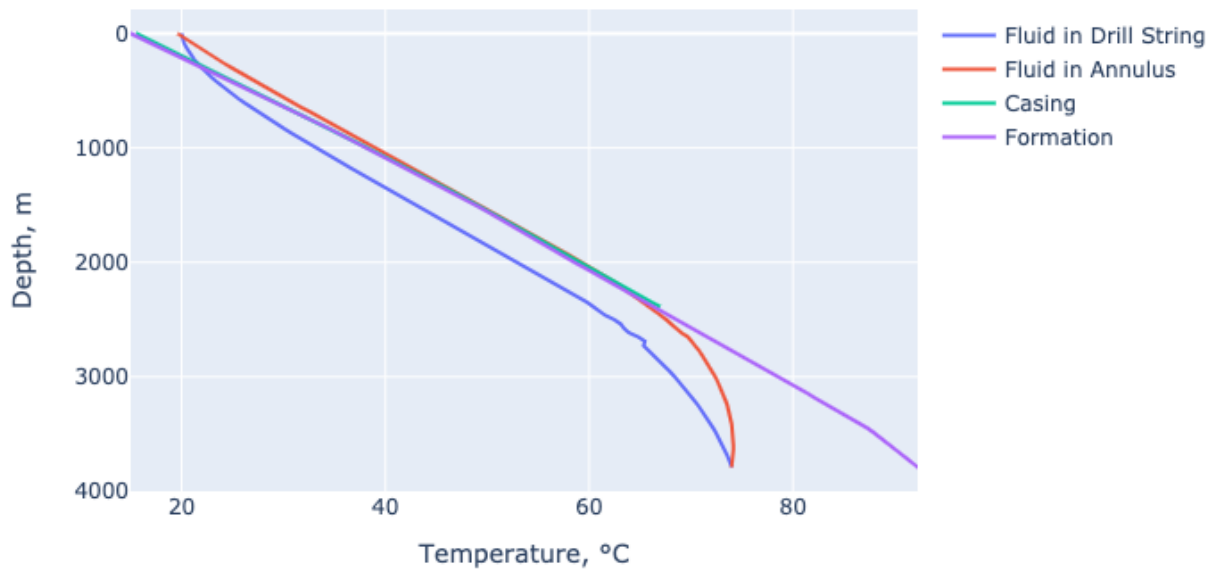
>>> well = pt.calc_temp(trajectory,      # calculate the well temperature distribution_
↳using pwptemp
```

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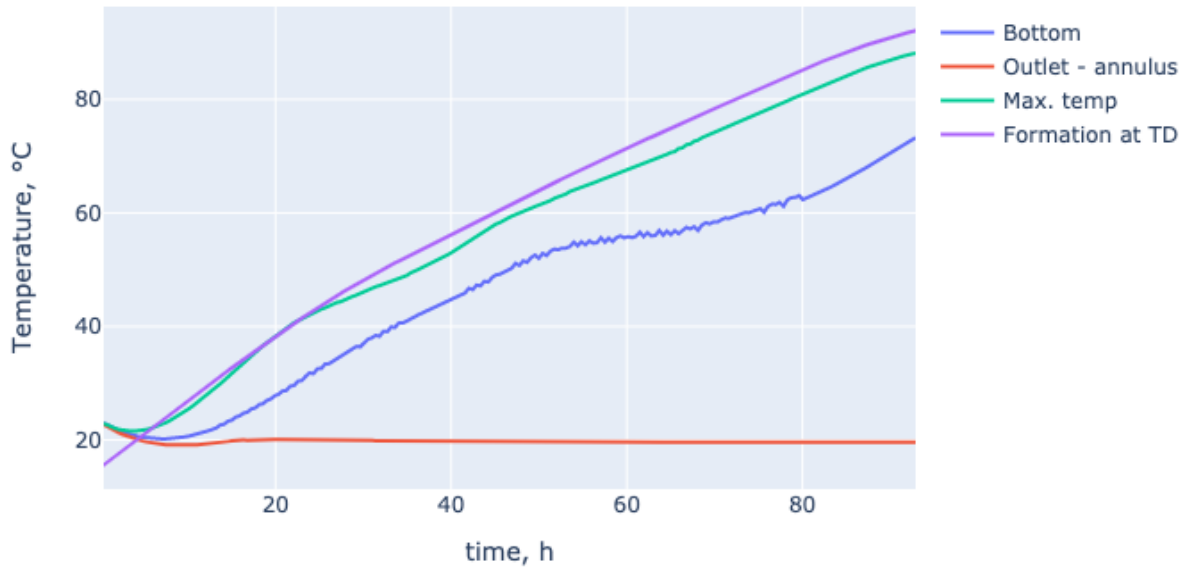
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```
>>> casings,  
>>> set_inputs={'water_depth': 0, 'temp_inlet': 20, 'rop':rop_  
↪list,  
>>> operation='drilling',}  
  
>>> pt.plot_distribution(well).show()
```

Temperature Profile at 92.9 hours of drilling



92.88 hours of operation



Notice!

The total time of drilling is calculated based on the ROP's set for the sections. The simulation assumes a break after each section is drilled (here is when casing is run and cemented) so the temperature becomes stable again. i.e. for this particular case, it takes 92.9 hours only *drilling* the whole wellbore.

The table below shows the available inputs that can be set when using the parameter *set_inputs*

Name	Units
temp_inlet	°C
temp_surface	°C
water_depth	in
pipe_id	in
pipe_od	in
riser_id	in
riser_od	in
fm_diam	in
flowrate	m3/min
Thermal Conductivities—————	
tc_fluid	W / (m °C)
tc_csg	W / (m °C)
tc_cem	W / (m °C)
tc_pipe	W / (m °C)
tc_fm	W / (m °C)
tc_riser	W / (m °C)

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Table 1 – continued from previous page

Name	Units
tc_seawater	W / (m °C)
Specific Heat Capacities————	
shc_fluid	J / (kg °C)
shc_csg	J / (kg °C)
shc_cem	J / (kg °C)
shc_pipe	J / (kg °C)
shc_riser	J / (kg °C)
shc_seawater	J / (kg °C)
shc_fm	J / (kg °C)
Densities————	
rho_fluid	sg
rho_pipe	sg
rho_csg	sg
rho_riser	sg
rho_fm	sg
rho_seawater	sg
rho_cem	sg
Others————	
th_grad_fm	°C/m
th_grad_seawater	°C/m
hole_diam	m
rpm	rev. per min.
tbit	kN*m
wob	kN
rop	m/h
an	in^2
bit_n	0 to 1
dp_e	0 to 1
thao_o	Pa
beta	Pa
alpha	1/°C
k	Pa*s^n
n	dimensionless
visc	cP

2.2 Web Application

There is also the web-app based on pwptemp:

TEMPERATURE DURING CIRCULATING

`pwptemp.calc_temp` (*trajectory*, *casings=None*, *set_inputs=None*, *operation='drilling'*, *time_steps=210*,
smooth=True, *cells_no=None*)

Function to calculate the well temperature distribution during a specific operation at a certain time.

Parameters

- **trajectory** – wellbore trajectory excellcsvdataframelist
- **casings** – list of dictionaries with casings characteristics (od, id and depth)
- **set_inputs** – dictionary with parameters to set.
- **operation** – define operation type. ('drilling', 'circulating')
- **time_steps** – number of time steps to run calculations.
- **smooth** – smooth the temperature profiles.
- **cells_no** – (int) number of cells. If None -> keep same number of cells than trajectory

Returns Well temperature distribution object

`pwptemp.temperature_behavior` (*well*)

Function to simulate the temperature behavior.

Parameters *well* (*obj*) – well temperature distribution object

Returns temperature behavior object

3.1 Example

```
>>> import pwptemp as pt
>>> import well_profile as wp

>>> trajectory = wp.load('trajectory1.xlsx', equidistant=True)      # using well_
↳profile to load a trajectory

>>> casings = [{'od': 12, 'id': 11, 'depth': 1200},                # creating 3 casings with_
↳respective parameters
>>>             {'od': 10, 'id': 9, 'depth': 1500},                # diameter [in] and depth [m]
>>>             {'od': 8, 'id': 7, 'depth': 2400}]

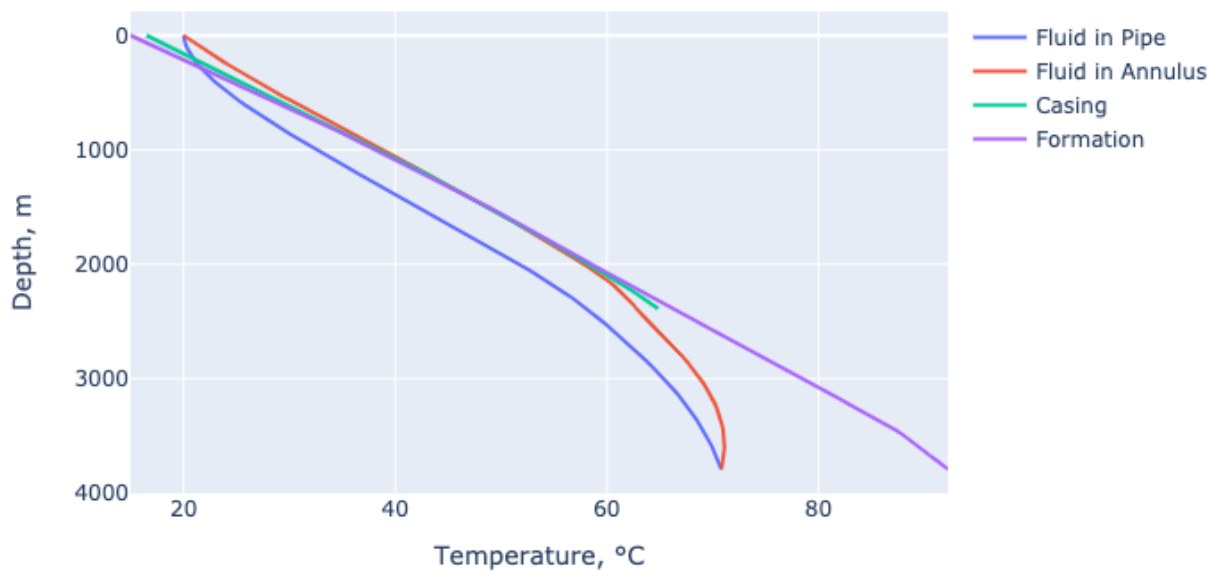
>>> well = pt.calc_temp(trajectory,                                # calculate the well temperature distribution_
↳using pwptemp
>>>                     casings,
>>>                     set_inputs={'water_depth': 0,              # water depth [m]
```

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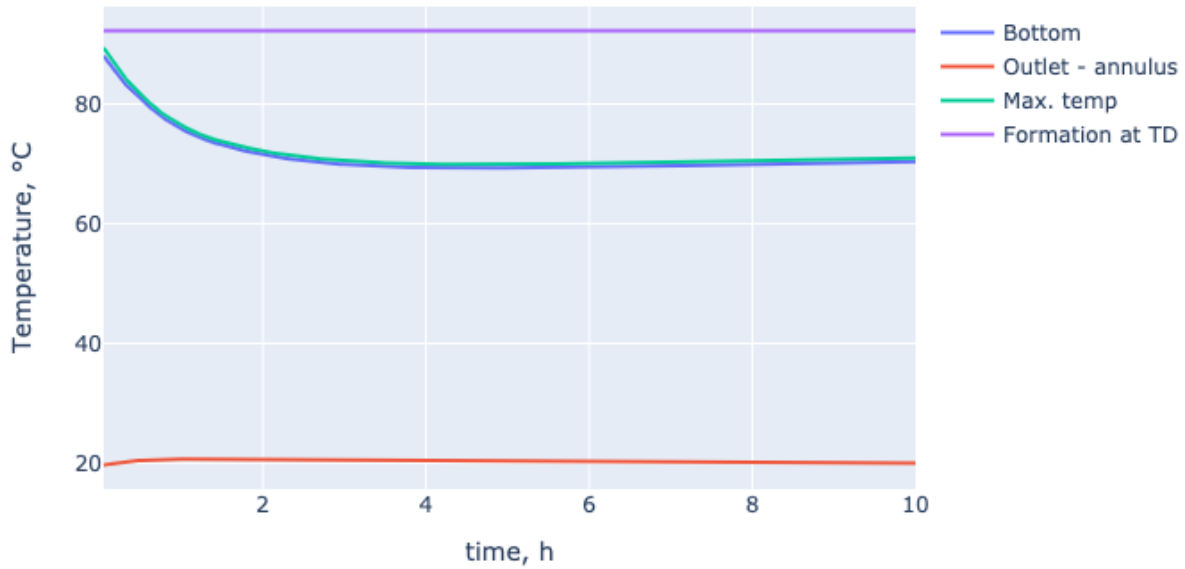
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```
>>>                                     'temp_inlet': 20,      # inlet fluid temperature, °C
↳ [°C]
>>>                                     'time': 10}           # circulation time [h]
>>>                                     operation='circulating',
>>> pt.plot_distribution(well).show()
```

Temperature Profile at 10.0 hours of circulating



10.0 hours of operation



The table below shows the available inputs that can be set when using the parameter *set_inputs*

Name	Units
time	h
temp_inlet	°C
temp_surface	°C
water_depth	in
pipe_id	in
pipe_od	in
riser_id	in
riser_od	in
fm_diam	in
flowrate	m3/min
Thermal Conductivities————	
tc_fluid	W / (m °C)
tc_csg	W / (m °C)
tc_cem	W / (m °C)
tc_pipe	W / (m °C)
tc_fm	W / (m °C)
tc_riser	W / (m °C)
tc_seawater	W / (m °C)
Specific Heat Capacities————	
shc_fluid	J / (kg °C)
shc_csg	J / (kg °C)
shc_cem	J / (kg °C)
shc_pipe	J / (kg °C)

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Table 1 – continued from previous page

Name	Units
shc_riser	J / (kg °C)
shc_seawater	J / (kg °C)
shc_fm	J / (kg °C)
Densities—————	
rho_fluid	sg
rho_pipe	sg
rho_csg	sg
rho_riser	sg
rho_fm	sg
rho_seawater	sg
rho_cem	sg
Others—————	
th_grad_fm	°C/m
th_grad_seawater	°C/m
hole_diam	m
rpm	rev. per min.
tbit	kN*m
wob	kN
rop	m/h
an	in^2
bit_n	0 to 1
dp_e	0 to 1
thao_o	Pa
beta	Pa
alpha	1/°C
k	Pa*s^n
n	dimensionless
visc	cP

3.2 Web Application

There is also the web-app based on pwptemp:

ABOUT PRO WELL PLAN

Pro Well Plan offers an easy and effective well planning platform for the entire team. Check out [our website](#) to know more about us.

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