4. Parameter file

The parameter file `param.txt` contains the information that is necessary for the simulation to run.

1. Geometry
    - Number of elements in each direction
    - The extension of the model
2. Time constrains
    - The time-step of the simulation
    - Maximum time-step of the simulation
    - Maximum time of the simulation (in seconds)
    - Maximum time between steps of the simulation (in seconds)
3. Viscosity values
    - The reference viscosity
    - The minimum viscosity
    - The maximum viscosity
4. Physical parameters
    - Gravity acceleration
    - Heat capacity
    - Coefficient of thermal conductivity
    - Coefficient of thermal expansion
5. Boundary conditions
    - Temperature boundary condition at all borders
    - Tangential velocity boundary conditions at all borders
    - Normal velocity boundary conditions at all borders
6. Rheology and temperature model numbers
7. External initial temperature from ASCII file
8. External initial interfaces from ASCII file
9. External initial velocity files from ASCII file
10. Type of solver
    - Direct
    - Iteractive
11. Simulation options
    - denok
    - rtol

Below there is an example of a parameter file `param.txt` used to make a simulation with *Mandyoc*.

```
# Geometry
nx                        = 281        # N. of elements in the longitudinal direction
nz                        = 85         # N. of elements in the vertical direction
lx                        = 2800000.0  # Extent in the longitudinal direction
lz                        = 850000.0   # Extent in the vertical direction

# Simulation options
# solver                  = direct     # [direct/iterative]
use_multigrid             = 1          # Enable multigrid
# residual_norm_iter      = 1.0e-5
# residual_norm_uzawa     = 1.0e-4

# Time constrains for the simulation
step_maxkjdfd             = 7000       # Maximum time-step of the simulation
step_print                = 10         # Make file every <step_print>
time_max                  = 14e9       # Maximum time of the simulation [s]
dt_max                    = 10.0e3     # Maximum time between steps of the simulation [s]

# Values for the viscosity
visc_ref                  = 1.0e+21    # Reference viscosity [Pa.s]
visc_max                  = 1.0e+23    # Maximum viscosity [Pa.s]
visc_min                  = 1.0e+19    # Minimum viscosity [Pa.s]

# External ASCII inputs
interfaces_from_ascii     = True       # Use 'interfaces.txt' ASCII file
# temperature_from_ascii  = True       # Use 'input_temperature_0.txt' ASCII file
velocity_from_ascii       = False      # Use 'input_velocity_0.txt' ASCII file

geo=on#kdjfkdjf
geoq_fac                  = 100.0
surf_veloc                = 0.0e-2.

temp_diff                 = 0


# Physical parameters
heat_capacity             = 1250.0     # Heat capacity [J/K]
gravity                   = 10.0       # Gravity acceleration [m/s^2]
kappa                     = 1.0E-6     # Coefficient of thermal conductivity [W/(m.K)]
alpha                     = 3.28E-5    # Coefficient of thermal expansion [1/K]
rho_mantle                = 3300.      # Mantle's reference density [kg/m^3]

# External heat per mass unit
external_heat             = 0.0

non_linear_method         = off
adiabatic_component       = off
radiogenic_component      = off

# Velocity boundary conditions
# Normal velocity
top_normal_velocity       = fixed
bot_normal_velocity       = fixed
left_normal_velocity      = fixed
right_normal_velocity     = fixed
# Tangential velocity
top_tangential_velocity   = free
bot_tangential_velocity   = fixed
left_tangential_velocity  = free
right_tangential_velocity = free

# Temperature boundary conditions
top_temperature           = fixed
bot_temperature           = fixed
left_temperature          = fixed
right_temperature         = fixed

# Rheology model
rheology_model            = 0          # Number of the rheology model for the simulation
initial_temperature       = 9          # Number of the temperature model for the simulation


# Initial model
```

```
74 # lithosphere_thickness   = 80.0e4
75 # air_layer_thickness     = 0.0
76 # beta_max                = 3.0
77 # ramp_begin              = 2000.0e3
78 # ramp_end                = 2200.0e3
```