# Task 2

For task 2 I also used PINNs to solve it. I used two DNNs, one for the fluid and one for the solid. I also tried only one DNN but this seemed to work worse than the approach with 2 DNNs. Each of the DNNs had 8 hidden layers with 100 nodes for each layer. I decided to go with a much wider and deeper NN than in task 1 such that it can understand the periodicity of the multiple cycles. Also, some tests with smaller NNs showed that they have a problem with timesteps that are in the second cycle. There are 1024 interior points used as well as 256 per spatial boundary and 128 temporal boundary points. I used more sample points compared to task 1 due to the larger domain. The main structure of the PINNs class is again from the tutorial file. To distinguish the different phases (idle, charging and discharging) for the sample I used a boolean tensor that contained the information about the phase. For this, I first divided the sample points modulo 4 since we have two identical cycles of length 4 each. Then I checked with logical expressions in which phase they are in. This is done in the functions `boundary_cond_0` and `boundary_cond_1`. The same procedure is done for the coefficient U in the pde when computing the pde residual. This is not done in a separate function but in `compute_pde_residual` itself. In the `compute_loss` function the residual for the given measurement points is added. Here the lambda value is chosen to be 100 to emphasize the loss corresponding to the boundaries and the measurement points. The model was trained over 5000 ADAM and 1 LBFGS epoch. The code was run in Google Colab using their GPUs to accelerate the training.