Report 30/04/2020 (2)

1 Other comments on the 1D problems

I have tried some of the problems in the other report with Picard, which works but is slower. I have also tried different β values ($\beta = 10^1$ and $\beta = 10^3$) and these work as expected($\beta = 10^1$ gives small improvement of J_{FW}, $\beta = 10^3$ solves in one iteration for the most part).
Looking at the first Neumann example from Report 1 again: Choosing $\gamma = 0.5$ and $\gamma = -0.5$ with $\beta = 10^{-1}$ shows the difference in the two γ values, see Figure 1.

2 Notes on 2D Problem

As mentioned in the email, the 2D problem with strong interaction does not work. For $N1 \times N2 = 60$, $n = 61$ and almost order 1 interaction strength, the Forward Problem doesn't return the solution at all time points. The initial condition was 0.5, a constant. This is for $\beta = 10^{-3}$ and $\beta = 10^{-1}$. For $\beta = 10^{-3}$ and interaction $\gamma = -0.5$, $\gamma = 0.5$, the forward problem is running correctly, but the optimization diverges at around 0.19, with $\hat{\rho} = 0.5(1-t) + t((1/2)\sin(\pi(y1 - 2)/2)\sin(\pi(y2-2)/2) + 1/2)$.
Changing $\hat{\rho}$ but messing up the first term...:

$$\hat{\rho} = 0.5(1-t) + t(1-t)0.5 + t(1/4)((\cos(\pi y1 + \pi) + 2)(\cos(\pi y2 + \pi) + 2)).$$

This converges for $\gamma = 0$ and $\gamma = -0.2$, but is not exactly the case I wanted to consider. $J_{FW} = 0.4635$, $J_{Opt} = 0.2766$, see Figure 2.

Choosing $\rho_{IC} = 0.5$ and $\gamma = -0.5$, the forward problem shows a considerable 'bump' in the middle of the domain. For $\gamma = -0.7$, this already looks very steep, so I am not surprised that larger values of γ cause the forward problem to fail.
Choosing $\hat{\rho}$ to also be a 'bump' in the middle of the domain:

$$\hat{\rho} = 0.5(1-t) + t\frac{1}{4}((\cos(\pi y1) + 2)(\cos(\pi y2) + 2)).$$

3 Quick demo of the plotting function

Three plots produced with the new plotting function, see Figures 3, 4 and 5.

4 Other things to discuss

- 2D plotting function

- Presentation at the E-symposium
- End of year review
- Class choices

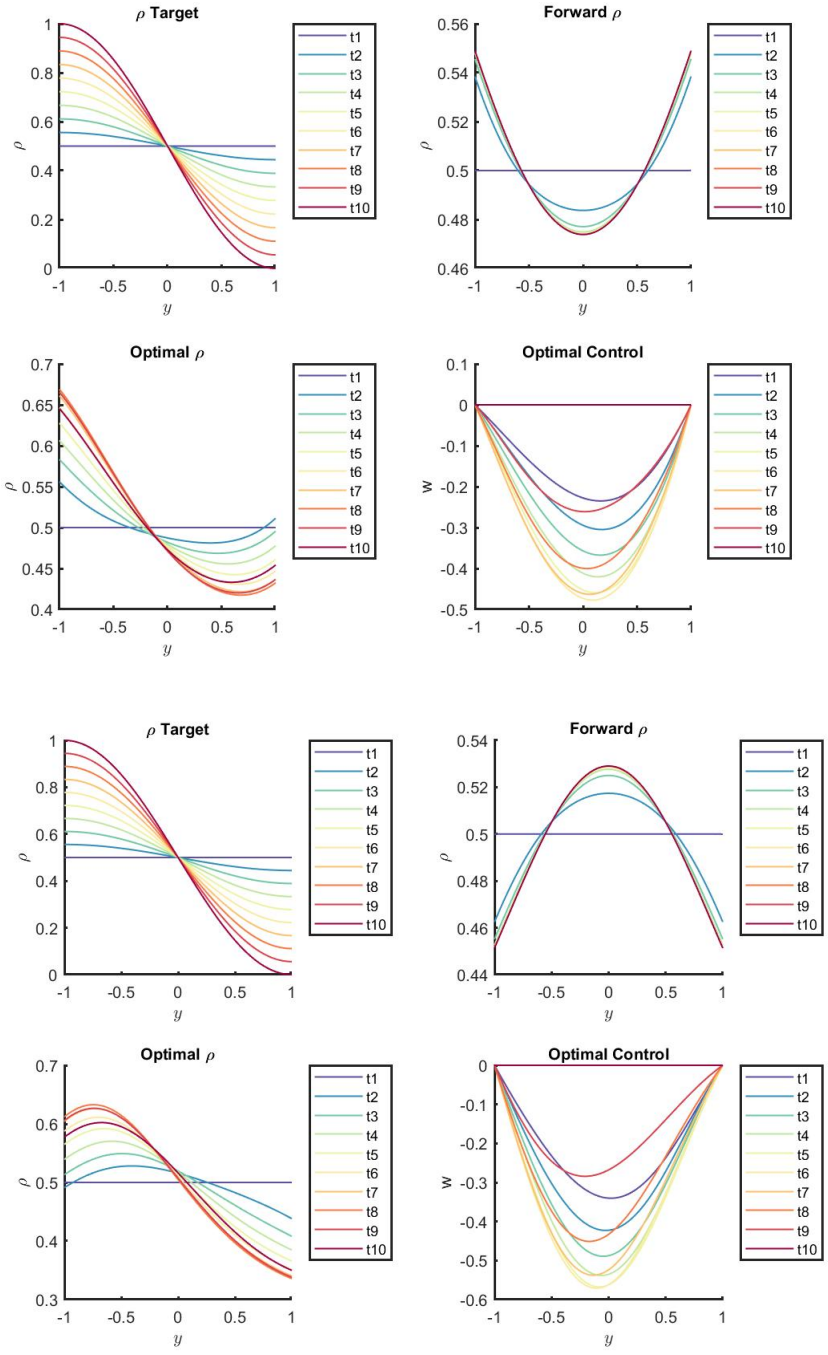

Figure 1: Results for Neumann Flow, $\gamma = -0.5$ and $\gamma = 0.5$.

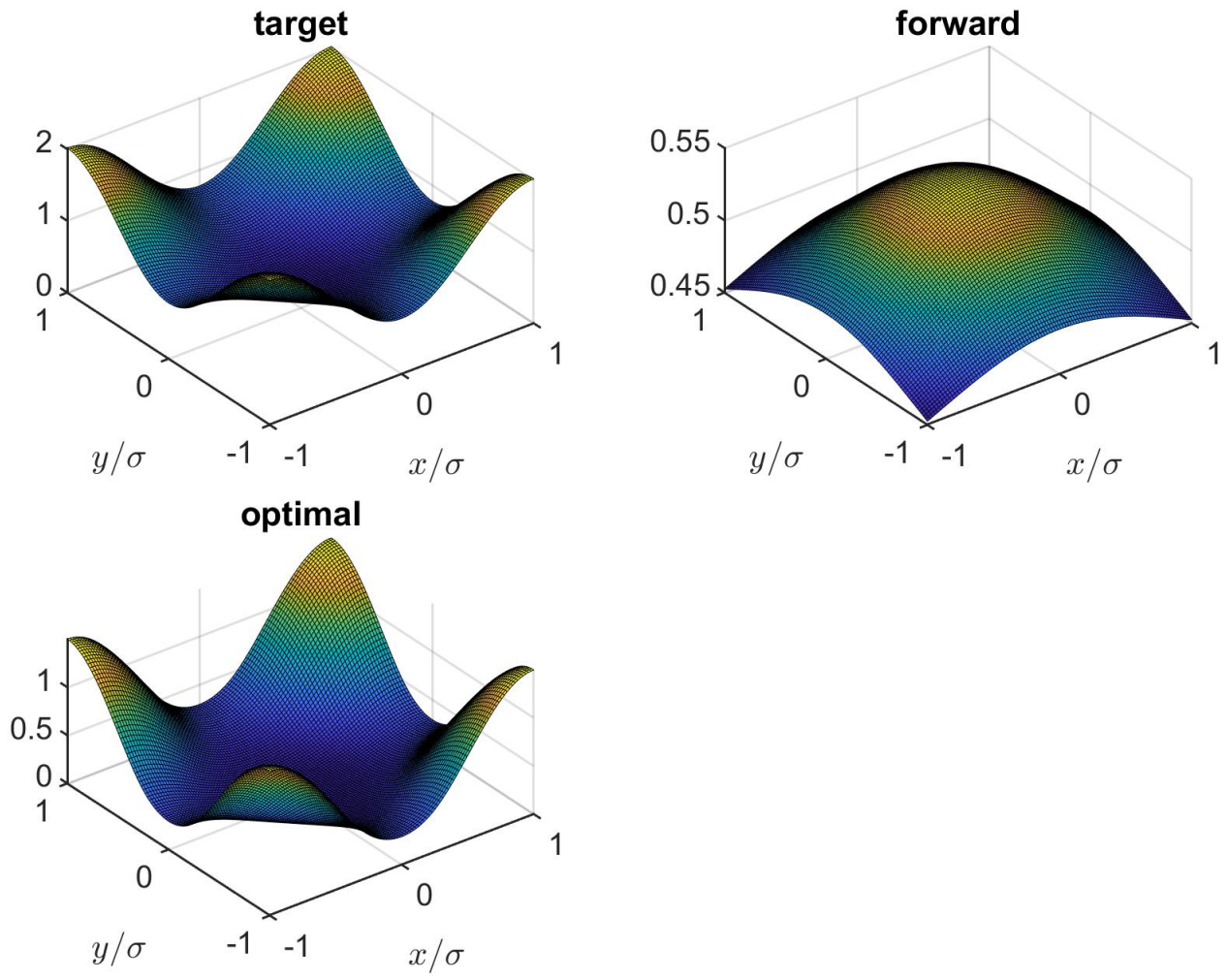

Figure 2: Results for Neumann Flow, $\gamma = -0.2$.

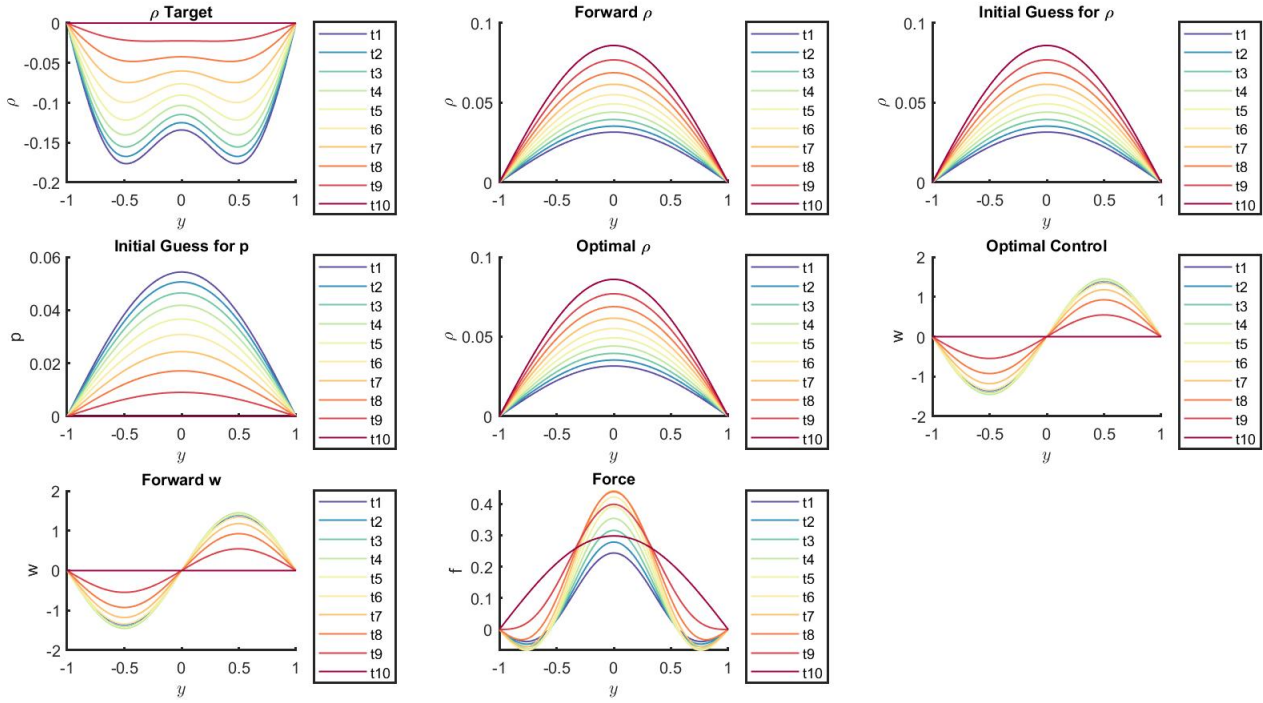

Figure 3: Demo of plotting function 1.

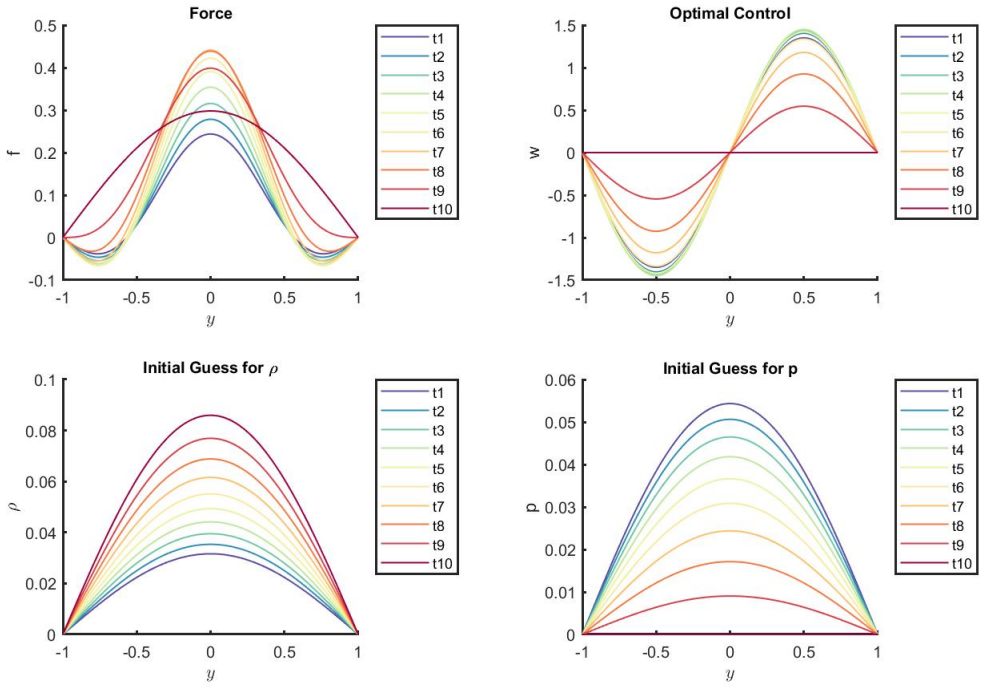

Figure 4: Demo of plotting function 2.

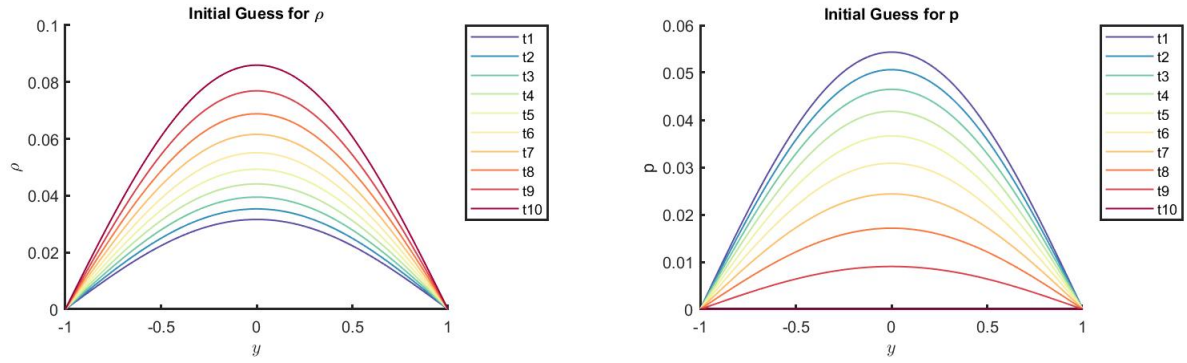

Figure 5: Demo of plotting function 3.