05-02-2020 Meeting Minutes – Nanoparticles Case Study

General Notes

- After additionally reviewing our supervisors' email, our boundary condition at $r = R(t)$ is incorrect.
    - It was missing a factor of D.
    - The derivation has been fixed in the Overleaf document and is now consistent with our supervisors' equations.
- We were able to re-derive the nondimensionalisation scaling factors (the ^ symbol is used to denote dimensional quantities)
    - $r = D_a \hat{r}$, where $D_a = \frac{k}{D}$ is a dimensionless quantity, which is called the Damköhler number.
    - There are two candidate time scales:
        - $t = \hat{t}\frac{k^2}{D}$ which removes all constants from the PDE.
        - $t = \hat{t}\frac{V_m \Delta c k^2}{D}$ which removes all the constants from the ODE.
- We are unsure which of these approaches are better.
- We are concerned that our two time scales are too similar.
- We are unsure how to choose Δc.
- We are unsure what physical intuition each of the suggested c scalings correspond to.
- We intend to update the Overleaf document to contain the non-dimensionalisation that we have completed so far, so that we can show it to our supervisor in our meeting tomorrow.

Questions for supervisor

- Are our time scales correct?
- Is there a reason why one of the time scales is better than the other?
- Is there an obvious way to choose Δc?
- Should be trying to scale space with respect to $R(t)$ so that our PDE is on a fixed domain?
- Should we be looking at numerical simulations?
- How do we go about generalising our model to the case when we have lots of nanoparticles?