

Notice of the Final Oral Examination  
for the Degree of Master of Science

of

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**A non-local reaction advection-diffusion model  
for self-interacting species**

## **Abstract**

In biological models, advection is inherently a non-local process. In this thesis, we proposed a nature extension of the non-local advection-diffusion model in [7] to include the reaction term (birth and death process). This thesis begins with an investigation of the well-posedness and existence of travelling wave solutions for this non-local reaction-advection-diffusion (RAD) equation. We prove the local-in-time existence and positivity of solutions under  $H^\beta(\cdot)$  initial conditions and provide a continuation criterion of the equation. Subsequently, we explore the existence of travelling wave solutions of this non-local RAD using a combination of perturbation methods, Fredholm operator theory, and Banach's fixed point theorem. Our analysis reveals that such solutions exist when the non-local advection term is small. Finally, we simulate the travelling wave solution to verify our theoretical findings.

[7] Valeria Giunta, Thomas Hillen, Mark Lewis, and Jonathan R Potts. Local and global existence for nonlocal multispecies advection-diffusion models.