

## **Marion Meutelet, IDP-Tours: Nonlinear reaction-diffusion problem with membrane conditions**

*mercredi 14 mai 2025 14:00 (30 minutes)*

The heat equation is a classical linear partial differential equation. I will illustrate its diffusive and regularizing effects through numerical simulations.

To move toward the framework of my subject, I will then introduce an interface within the domain, which splits the medium into two subdomains. At this interface, appropriate transmission conditions must be imposed to describe heat transfer between the regions. In particular, I will focus on the Kedem-Katchalsky conditions, which model semi-permeable membranes and are widely used in biological contexts.

Next, I will discuss a nonlinear extension of the heat equation, motivated by biological models, especially those describing tumor invasion through biological tissues. This leads to a reaction-diffusion system with nonlinear interface conditions.

We will see that the study of an associated elliptic (stationary) problem provides results, such as existence and uniqueness of a weak solution, that can be extended to the evolution problem thanks to nonlinear semigroup theory.