PARTIAL DIFFERENTIAL EQUATIONS IN MATERIAL SCIENCE

Molecular beam epitaxy is a method of coating surfaces with very thin layers of some material. In many models of molecular beam epitaxy, the height of the coating is represented by a function $u : \Omega \times (0, +\infty) \to \mathbb{R}$, where Ω is a bounded domain which represents the surface, which satisfy a nonlinear partial differential equation of the form

$$u_t + \Delta^2 u + \nabla \cdot f(\nabla u) = 0.$$

Often, when studying a nonlinear problem, we first solve a linear problem, and use that to construct the solution of the nonlinear problem. For this project, you will study the linear inhomogeneous equation

$$u_t + \Delta^2 u = f.$$

In particular, the goal is to construct weak solutions to this equation subject to appropriate initial and boundary conditions. By proving the existence and uniqueness of solutions, it is conjectured that it will be possible to construct solutions to the nonlinear problems stated above.