

Compactness estimates for approximate solutions of stochastic conservation laws

Introduction:

Conservation laws with stochastic perturbations arise in models of physical systems where uncertainty plays a role, such as fluid dynamics in random environments. While compactness estimates for deterministic conservation laws are well-understood, the stochastic case introduces new challenges due to the presence of noise and the need for adapted numerical methods. The introduction of stochastic terms requires extending the existing convergence framework to handle stochastic differential equations.

Main Goal:

This project will focus on extending the convergence framework and numerical methods for deterministic conservation laws to stochastic conservation laws. The student will adapt existing compactness estimates to handle stochastic effects by building on the works [1,2]. The project will also explore new techniques for proving convergence in the presence of stochastic forcing, and evaluate numerical methods that can efficiently handle the stochastic nature of the solutions. The implementation aspect will involve coding numerical schemes that incorporate stochastic forcing into conservation laws, testing their efficiency and accuracy in various scenarios.

References:

- [1] K. H. Karlsen. Quantitative compactness estimates for stochastic conservation laws. In Proceedings of HYP2022, SEMA SIMAI Springer Ser. Springer, Cham, 2024.
- [2] K. H. Karlsen and J. D. Towers. Compactness estimates for difference schemes for conservation laws with discontinuous flux. IMA J. Numer. Anal., 2024.