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Stochastic amplitude modulation of nonlinear dispersive waves

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STELLINGEN

Behorende bij het proefschrift

Stochastic Amplitude Modulation of Nonlinear Dispersive Waves

1. [**Chapter 2**] The notion of variational phase for stochastic traveling waves, originating in linear stability theory, extends naturally to the scaling parameter of KdV solitons. This provides a concrete framework for analyzing amplitude effects of waves propagating through random environments.
2. [**Chapter 3**] When energy is supplied to or extracted from a KdV soliton in a deterministic manner, this primarily leads to amplitude modulation. In particular, the soliton can be stably amplified to arbitrary amplitude.
3. [**Chapter 4**] Under stochastic energy supply or loss, a KdV soliton generates a radiative wake whose energy content scales proportionally to the induced amplitude fluctuations.
4. [**Chapter 5**] Understanding the slow amplitude and energy decay of radiating solitary waves requires a detailed description of the radiative wake following the wave.
5. While the analysis of discrete systems (LDEs) may appear simpler than that of continuous systems (PDEs), the study of traveling waves in discrete media typically requires techniques from continuous analysis, whose translation to the discrete setting can be quite intricate.

6. When faced with a complex (mathematical) problem, reducing it to a minimal setting often reveals the essential mechanism in full clarity.
7. Once the core structure of a (mathematical) problem is identified, it can be abstracted and extended to the broadest relevant setting.
8. Applied mathematics should avoid overcomplicating itself with theoretical machinery and instead rely on the simplest tools that effectively address the problem.
9. The true value of theoretical mathematics lies in revealing insights that are not already apparent from computational exploration.
10. Academia should promote competitive and relevant scientific research, while guaranteeing opportunities and stability for early-career researchers.

Rik Westdorp,
Leiden, 2 April 2026