Malliavin calculus for the stochastic Cahn-Hilliard/Allen-Cahn equation with unbounded noise diffusion

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ABSTRACT

The stochastic partial differential equation analyzed in this work, is motivated by a simplified mesoscopic physical model for phase separation. It describes pattern formation due to absorption and desorption mechanisms involved in surface processes, in the presence of a stochastic driving force. This equation is a combination of Cahn-Hilliard and Allen-Cahn type operators with a multiplicative, white, space-time noise of unbounded diffusion. We apply Malliavin calculus [1], in order to investigate the existence of a density for the stochastic solution u. In dimension one, according to the regularity result in [2], u admits continuous paths a.s. Using this property, and inspired by a method proposed in [3], we construct a modified approximating sequence for u, which properly treats the new second order Allen-Cahn operator. Under a localization argument, we prove that the Malliavin derivative of u exists locally, and that the law of u is absolutely continuous, establishing thus that a density exists.

REFERENCES

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