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Morita approximations to random copolymer localization

We look at Morita approximations to analyze Dyck path models of random copolymer localization at an interface between two immiscible liquids. A polymer can be either delocalized, with zero density of monomers at the interface, or localized, with a non-zero density of monomers at the interface.

The phase diagram for the first order Morita approximation, which constrains the number of one type of comonomers, consists of four distinct regions: two delocalized regions, a localized region, and a region of coexistence of the two delocalized regions.

It is known that the boundaries of the delocalized regions do not change as the order of the Morita approximation is increased. It is also known that the region of coexistence of the two delocalized regions is not present in the quenched model, it is a localized region instead. We have some numerical evidence that points toward the existence of the region of coexistence of the two delocalized regions for Morita approximations of up to eighth order. We also have some arguments that point toward localization in the region of coexistence of the two delocalized regions, for Morita approximations of twelfth order and above.

We get tighter upper bounds on the average constrained free energy as the order of the Morita approximation increases.