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Local stability and ergodic theorems for amenable groups

There are analogues of many classical ergodic theorems where, instead of considering the action of a single transformation on a measure space, one considers the action of a group with certain geometric properties. However, outside of a few special cases, explicit versions of ergodic theorems for group actions (i.e., giving some quantitative information about the convergence of the ergodic average) are not known. Likewise, it is unclear whether the convergence behaviour is sensitive to the regularity of the function under consideration, analytic properties of the underlying space, etc. Here, we give a version of the mean ergodic theorem for amenable groups, where the ergodic average is specified by a Følner sequence. In this setting, we show there exists a uniform bound on the rate of metastability (or local stability) of the ergodic average which depends on an intrinsic convergence parameter of the Følner sequence itself. This extends the previous work of Avigad, Gerdardy, and Towsner on local stability for the classical mean ergodic theorem.