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Variational inequalities for two-parameter averages over tori

Variational inequalities have been extensively studied in various branches of mathematics. In particular, variational inequalities for averaging operators provide valuable insights into the pointwise convergence properties of averages. While maximal averaging operators offer similar results, variational inequalities yield more refined and powerful information regarding the behavior of averages. In this talk, we focus on a variational inequality for a two-parameter averaging operator. Indeed, a well-defined formulation of variational inequalities for two-parameter averages has not yet been established. We introduce a precise definition for two-parameter averages over tori and present a sharp boundedness result.