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Asymptotic statistical characterizations of p-harmonic functions of two variables

It is well known that harmonic functions are characterized by the mean value property. Building on recent work of Manfredi, Parviainen and Rossi, we generalize this result, proving that a p-harmonic function of two variables satisfies, in a viscosity sense, two asymptotic formulas involving its local statistics. Moreover, we show that these asymptotic formulas characterize p-harmonic functions when $1 < p < \infty$. An example demonstrates that, in general, these formulas do not hold in a non-asymptotic sense. This is joint work with Matthew Rudd (University of the South).