CCIT REPORT #766 May 2010

Threshold Effects in Parameter Estimation as Phase Transitions in Statistical Mechanics

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Abstract

Threshold effects in the estimation of parameters of non–linearly modulated, continuous–time, wide-band waveforms, are examined from a statistical physics perspective. These threshold effects are shown to be analogous to phase transitions of certain disordered physical systems in thermal equilibrium. The main message, in this work, is in demonstrating that this physical point of view may be insightful for understanding the interactions between two or more parameters to be estimated, from the aspects of the threshold effect.

Index Terms: Non–linear modulation, parameter estimation, threshold effect, additive white Gaussian noise channel, bandwidth, statistical physics, disordered systems, random energy model, phase transitions.