Adjointness of probability and energy in models of statistical physics

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Abstract. For the purpose of studying infinite systems of statistical physics, Dobrushin in [1,2] and, independently, Lanford and Ruelle in [3] introduced the fundamental notion of Gibbs random field and established its most important properties. The definition of Gibbs random field is directly related to the problem of prescribing a system of random variables by means of consistent system of conditional distributions (specification). In [4] Dachian and Nahapetian showed that for a system of conditional distributions to be a specification it is necessary and sufficient that its elements have a Gibbs form. This result establishes a straightforward relationship between the probabilistic notion of (Gibbs) random field and the physical notion of energy (Hamiltonian). In the given consideration, we show that the problem of prescribing an infinite system of random variables by means of conditional distributions can be considered from the algebraic point of view as a problem of consistency of an appropriate infinite system of linear equations. We demonstrate that a potential energy (transition energy field) and probability (specification) are connected as the solutions of corresponding adjoint infinite systems of linear equations.

References

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