

Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Properties of the Ising Model Density of States ROBERT HOSKEN,

The Aerospace Corporation — The Ising model Density of States (DOS) is a histogram of all the Ising model microstates binned into macrostates with the same values of the energy variables, magnetism and interaction energy. When the DOS three-dimensional surface is known analytically it can be multiplied by the Boltzmann function and summed over all possible values of the energy variables to obtain the statistical mechanics partition function, Z , where Z is a function of the temperature, the single bond energy strength, and the external magnetic field. This summation becomes an integration in the thermodynamic limit, and the result is exact in the high temperature regime. Analytical expressions for the descriptive statistics of the energy variables are presented for nearest neighbor spin interactions in a linear chain, a square lattice, and a simple cubic lattice, all for the case of periodic boundary conditions. The properties considered are the moments of the variables to the fourth order: mean, variance, correlation, skewness, and kurtosis. The DOS surface has a single peak with a known location and height, and the base of the surface lies within an isosceles triangle. Examination of this triangle shows the feasible ferromagnetic and antiferromagnetic regions, and the location of the ground states.

Robert Hosken
The Aerospace Corporation

Date submitted: 08 Nov 2012

Electronic form version 1.4