Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Properties of the networks of same-spin sites in each Ising Model macrostate ROBERT HOSKEN, The Aerospace Corporation — An Ising Model macrostate contains all the microstates with the same energy. Each macrostate is labeled in an energy two-space by the two sums in the Hamiltonian, one for the magnetism and the other for the interaction energy. In a single macrostate, a network can be defined for all the up-spin sites and another network for all the down-spin sites. An exact formula has been derived that explicitly provides the total number of connection links (edges) in both of these macrostate networks. This derivation follows from a meticulous analysis of the calculation of the sum of the product of spins in the Hamiltonian. It is applicable to one, two, and three dimension Ising models with periodic boundary conditions. The formula permits calculation of the total number of nearest-neighbor connections for all of the sites, and thus the average number of connections per site. The number of connections can be used to calculate the probability that a nearest neighbor in a particular direction at a spin site has the same spin. This probability can be used to infer the closeness of any macrostate to the ferromagnetic ground states, the paramagnetic region, or the anti-ferromagnetic ground states. Note that these properties of each macrostate do not require knowledge of the number of microstates in the macrostate (the density of states).

Robert Hosken
The Aerospace Corporation

Date submitted: 04 Nov 2015 Electronic form version 1.4