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Universal scaling and the essential singularity at the Ising first-order transition JARON KENT-DOBIAS, JAMES SETHNA, Cornell — The Ising model is perhaps the most-studied problem in physics. Near its continuous phase transition the model's thermodynamic quantities diverge or vanish with power laws and logarithms. The renormalization group connects the exponents in these functions to those of an RG fixed point because, as an analytic transformation, it preserves all nonanalytic behavior. These power laws and logarithms are not the only nonanalytic feature near the critical point, however—as one approaches the line of first order transitions as $H \to 0$ for $T < T_c$, the free energy develops an essential singularity of the form e^{-1/H^x}. Though difficult to observe directly because it vanishes so quickly, this singularity is universal and should affect scaling analysis near the critical point for $T < T_c$ and $H \neq 0$. We produce universal scaling forms that include this contribution and use them to better fit numeric Ising data.

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