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High-Precision Thermodynamic and Critical Properties from Tensor Renormalization-Group Flows MICHAEL HINCZEWSKI, TUBITAK - Bosphorus Univ. Feza Gursey Institute, A. NIHAT BERKER, Koç Univ. and M.I.T. — The recently developed tensor renormalization-group (TRG) method [1] provides a highly precise technique for deriving thermodynamic and critical properties of lattice Hamiltonians. The TRG is a local coarse-graining transformation, with the elements of the tensor at each lattice site playing the part of the interactions that undergo the renormalization-group flows. These tensor flows are directly related [2] to the phase diagram structure of the infinite system, with each phase flowing to a distinct surface of fixed points. Fixed-point analysis and summation along the flows give the critical exponents, as well as thermodynamic functions along the entire temperature range. Thus, for the ferromagnetic triangular lattice Ising model, the free energy is calculated to better than 10^{-5} along the entire temperature range. Unlike previous position-space renormalization-group methods, the truncation (of the tensor index range D) in this general method converges under straightforward and systematic improvements. Our best results are easily obtained with $D = 24$, corresponding to 4624-dimensional renormalization-group flows. [1] M. Levin and C.P. Nave, Phys. Rev. Lett. 99, 120601 (2007). [2] M. Hinczewski and A.N. Berker, arXiv:0709.2803v1 [cond-mat.stat-mech], Phys. Rev. E, in press.

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