Critical behaviour of a 3D Ising-like system in the ρ^6 model approximation: Role of the correction for the potential averaging

I.V. Pylyuk[a] and M.V. Ulyak[b]

[a] *Institute for Condensed Matter Physics of the National Academy of Sciences of Ukraine, 1 Svientsitskii Str., 79011 Lviv, Ukraine, E–mail: piv@icmp.lviv.ua*

[b] *Chervonograd State College of Mining Technologies and Economics, 17 Stusa Str., 80100 Chervonograd, Ukraine, E–mail: umwl@ukr.net*

The critical behaviour of systems belonging to the three-dimensional Ising universality class is studied theoretically using the collective variables (CV) method presented in [1,2]. The description of the critical behaviour of a one-component spin system can be improved by the application of the non-Gaussian sextic distribution of order-parameter fluctuations (the ρ^6 model) [2,3].

The partition function of the system is calculated by the integration over the layers of the CV phase space in the approximation of the ρ^6 model. A specific feature of this calculation consists in making allowance for the dependence of the Fourier transform of the interaction potential on the wave vector. Including the correction for the potential averaging leads to a nonzero critical exponent of the correlation function η and the renormalization of the values of other critical exponents (for the correlation length, susceptibility, etc.). The contributions from the correction for the potential averaging to the recurrence relations for the ρ^6 model, fixed-point coordinates, and matrix elements of the renormalization-group linear transformation are singled out. The expression for the critical exponent η is obtained in the higher non-Gaussian approximation.

1. I.R. Yukhnovskii, *Phase Transitions of the Second Order. Collective Variables Method* (World Scientific, Singapore, 1987).
2. I.R. Yukhnovskii, M.P. Kozlovskii, and I.V. Pylyuk, *Microscopic Theory of Phase Transitions in the Three-Dimensional Systems* (Eurosvit, Lviv, 2001) [in Ukrainian].
3. I.R. Yukhnovskii, M.P. Kozlovskii, and I.V. Pylyuk, Ukr. J. Phys. **57**, 80 (2012).