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Investigation of the $O(n)$-symmetric $\varphi^4 + \varphi^6$ theory using renormalization group method to six loops

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Tricritical behavior in systems with an n-component order parameter $\varphi = \{\varphi_a, a = 1, \dots, n\}$ is described by the action $S(\varphi) = \frac{1}{2}\partial_i\varphi_a\partial_i\varphi_a + \frac{\tau}{2}\varphi_a\varphi_a + \frac{\lambda}{4!}(\varphi_a\varphi_a)^2 + \frac{g}{6!}(\varphi_a\varphi_a)^3$, where the coefficients τ, λ and g are parameters of the model [1].

Six-loop calculation of the renormalization group functions in the model was carried out in $d = 3 - \varepsilon$ dimensions using the dimensional regularization. The model was renormalized within the minimal subtraction scheme (MS) [1]. All diagrams, except seven diagrams, were calculated with G-functions [2]. For the remaining seven six-loop diagrams, the G-function approach allowed to reduce them to two-loop diagrams, which were computed numerically using the Sector Decomposition method [3]. The results obtained differ from those previously known [4].

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