Calculation of Pincus force in the framework of massive field theory approach

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Taking into account the well known correspondence between the field theoretical ϕ^4 $O(n)$-vector model in the limit $n \to 0$ and the behavior of long-flexible polymer chains in a good solvent the force which ideal and real polymer chain with excluded volume interactions with free end exerts on the surface when the second end is fixed on the surface was calculated: $\frac{f}{k_B T} = \frac{\partial}{\partial z_B} ln Z_N(z_A = 0, z_B)$, where $Z_N(z_A = 0, z_B)$ is the partition function of polymer chain with free end in the layer z_B and fixed other end on the surface $z_A = 0$, N is number of monomers. The above mentioned force is analogous to the well known Pincus force [1, 2], which is necessary to apply in order to detach single polymer chain from homogeneous surface. The calculations of the force for real polymer chain with excluded volume interactions are performed up to one-loop order with using the massive field theory approach in fixed space dimensions $d < 4$.

References

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