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Polymer solutions of real polymer chains in confined geometries and under tension of stretching forces: massive field theory approach

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Application of the massive field theory approach in fixed space dimensions d=3 up to one-loop order for : 1) investigation of critical behaviour of real polymer chains with excluded volume interactions immersed in good solvents and confined in: a) semi-infinite space with the surface; b) slit geometry of two parallel walls; c) between wall and a mesoscopic spherical particle of big radius and 2) investigation of the mechanical properties of single polymer chain unchored by one end on the surface and other end being under tension of the external applied force as it usually takes place in the single-molecule force spectroscopy techniques. It should be mentioned that in all the above mentioned cases was taken into account that surfaces could be repulsive or inert for polymer chains. The obtained results include calculations of the layer monomer density profiles, depletion interaction potentials and depletion interaction forces which arise in polymer solutions between walls and dependence of the applied force upon stretching of real polymer chain in good solvent on the distance from the surface. The obtained results are in excellent qualitative and quantative agreement with previous theoretical investigations, results of Monte Carlo simulations and experimental data and have important practical applications for creation of new nano- and micro- mechanical devices with low static friction and understanding of the elastic properties of the individual macromolecules.