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Pulling self-interacting linear polymers on a family of fractal lattices embedded in three-dimensional space

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Abstract. We have studied the problem of force pulling self-interacting linear polymers situated in fractal containers that belong to the Sierpinski gasket (SG) family of fractals embedded in three-dimensional (3D) space. Each member of this family is labeled with an integer b ($2 \leq b \leq \infty$). The polymer chain is modeled by a self-avoiding walk (SAW) with one end anchored to one of the four boundary walls of the lattice, while the other (floating in the bulk of the fractal) is the position at which the force is acting. By applying an exact renormalization group (RG) method we have established the phase diagrams, including the critical force–temperature dependence, for fractals with $b = 2, 3$ and 4. Also, for the same fractals, in all polymer phases, we examined the generating function G_1 for the numbers of all possible SAWs with one end anchored to the boundary wall. We found that besides the usual power-law singularity of G_1, governed by the critical exponent γ_1, whose specific values are worked out for all cases studied, in some regimes the function G_1 displays an essential singularity in its behavior.

Keywords: solvable lattice models, critical exponents and amplitudes (theory), phase diagrams (theory), polymers, polyelectrolytes and biomolecular solutions

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