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Self-avoiding walks on self-similar structures: finite versus infinite ramification

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Abstract
Self-avoiding walks (SAWs) generated by exact enumeration techniques are studied on the Sierpinski carpet ($d = 2$) and on the Sierpinski sponge ($d = 3$) (also called Sierpinski square lattices). A detailed comparison of the results for SAWs on these infinitely ramified fractals to SAWs on finitely ramified Sierpinski gaskets (Sierpinski triangular lattices), on regular lattices, and on the incipient percolation cluster is done, providing insight into the behaviour of SAWs on ordered and disordered structures. The SAWs on Sierpinski square lattices are found to display a kind of intermediate behaviour, sharing aspects of both SAWs on ordered and on fractal structures. As a consequence, a des Cloizeaux relation does *not* seem to hold for this structure, as opposed to its validity for SAWs on regular lattices, on Sierpinski triangular lattices and on the incipient percolation cluster.

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1. Introduction

Linear polymers made of similar monomer units in a diluted solution display only short-range (repulsive) interactions if the solvent is able to screen all long-range forces between them. In such a good solvent, the linear chain can be accurately modelled by a self-avoiding walk (SAW) (see [1–3] for a comprehensive review). SAWs are customarily studied on a lattice, for which many statistical properties are known so far (cf the above references). Some exponents characterizing the SAWs have even been established in exact form. For example, the Flory relation $\nu = 3/(d+2)$ [4] for the exponent ν, describing the scaling behaviour of the polymers' radius of gyration as a function of the number of monomers, has very recently been proved by Hueter [5] to be *exact* for SAWs in $d = 2$ and, furthermore, been rigorously generalized to $\nu = \max\{1/2, 1/4 + 1/d\}$ valid for any dimension $d \geqslant 2$ (correcting, for SAWs, the

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