DNA shape as a Brownian path on the Euclidean group

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The sequence dependent structural and elastic properties of DNA on the scale of a single base–pair are important in a number of essential biological processes. Parameters of corresponding rigid base–pair elastic potentials have been determined experimentally. How do these relate to longer scale conformations of the polymer, described by coarse–grained models such as the worm–like chain?
We show how to interpolate the naturally discrete base–pair DNA by a best-matching continuous stochastic process with the full set of rotational and translational local degrees of freedom. It is described by a path integral on the special Euclidean group SE(3).

Counterintuitive chain statistics can arise when DNA has an intrinsically supercoiled structure.