Freely Jointed Chain (FJC) [pln50]

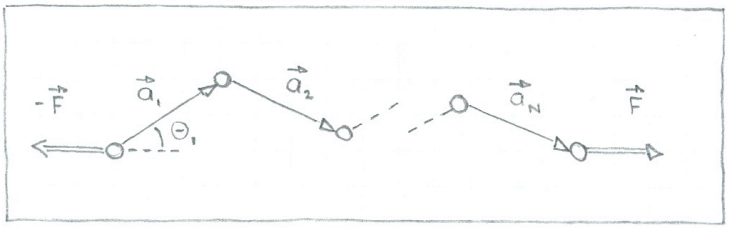
Random walk:

In the presence of only a random force exerted by the medium on each monomer the equilibrium conformation of an FJC polymer is a random walk. Self-avoidance and other volume interactions are negelcted as are constraints or elastic energies associated with the joints.

- Bond vector: $\mathbf{a}_i$,
- end-to-end distance vector: $\mathbf{r} = \sum_{i=1}^{N} \mathbf{a}_i$,
- free-joint condition: $\langle \mathbf{a}_i \cdot \mathbf{a}_j \rangle = a^2 \delta_{ij}$,
- mean-square distance: $\langle \mathbf{r}^2 \rangle = \sum_{i,j=1}^{N} \langle \mathbf{a}_i \cdot \mathbf{a}_j \rangle = Na^2$.
- rms end-to-end distance: $R_0 = \sqrt{N}a$.

Force-extension characteristics:

When the polymer experiences a stretching force F of growing strength, its conformation gets gradually more extended.



The FJC model approximates the stretching force as acting on each monomer in the same way, namely as a force seeking to align each monomer with the direction of the force in 3D space.

The solution of the FJC model is worked out in [pex53]. It shows some unphysical features associated with the entropy, which can be avoided by discretizing the orientations as shown in [pex54] and [pex55].

The continuous and discrete versions of the FJC model are equivalent to well-known models of ideal classical and quantum paramagnets, respectively.