Title:	Unzipping DNA by a periodic force: Hysteresis loop area and its scaling
Authors:	Kapri, R. (/jspui/browse?type=author&value=Kapri%2C+R.)
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Abstract:	Using Monte Carlo simulations, we study the hysteresis in the unzipping of double-stranded DNA whose ends are subjected to a time-dependent periodic force with frequency (ω) and amplitude (G). For the static force, i.e., ω→0, the DNA is in equilibrium with no hysteresis. On increasing ω, the area of the hysteresis loop initially increases and becomes maximum at frequency ω∗(G), which depends on the force amplitude G. If the frequency is increased further, we find that for lower amplitudes the loop area decreases monotonically to zero, but for higher amplitudes it has an oscillatory component. The height of subsequent peaks decreases, and finally the loop area becomes zero at very high frequencies. The number of peaks depends on the length of the DNA. We give a simple analysis to estimate the frequencies at which maxima and minima occur in the loop area. We find that the area of the hysteresis loop scales as 1/ω in the high-frequency regime, whereas it scales as Gαωβ with exponents α=1 and β=5/4 at low frequencies. The values of the exponents α and β are different from the exponents reported earlier based on the hysteresis of small hairpins.
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