Yin-Yang spiraling transition of a confined buckled elastic sheet

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TABLE I. Properties of the elastic sheet: the different samples of polyester (polyethylene terephtalate), their Young modulus E, thickness t, width W, length L_0 (and their bending moduli B are computed); and of the confining geometry: the gap h. The number of realizations repeated for the same control parameters is indicated. Polyesters A, B and C have the same Young modulus $E = 2.5$GPa, while polyesters 1, 2 and 3 have $E = 4.0$GPa and polyester α has $E = 5.0$GPa.

Material	E (GPa)	t (μm)	W (cm)	L_0 (cm)	h (mm)	B (J)	Nb of realizations
Polyester A	2.5	60	20	23.5	10	$5\,10^{-5}$	4
Polyester 1	4.0	75	20	20	10	$2\,10^{-4}$	3
Polyester B	2.5	90	20	23.5	$[5:5:40]$	$2\,10^{-4}$	3
Polyester 2	4.0	100	$5, 10, 20$	$5, 10, 20$	$10, 20, 40$	$4\,10^{-4}$	3
Polyester α	5.0	120	20	23.5	$[5:5:40]$	$9\,10^{-4}$	3
Polyester 3	4.0	125	20	20	10	$8\,10^{-4}$	3
Polyester C	2.5	340	20	23.5	$30, 35$	10^{-2}	4

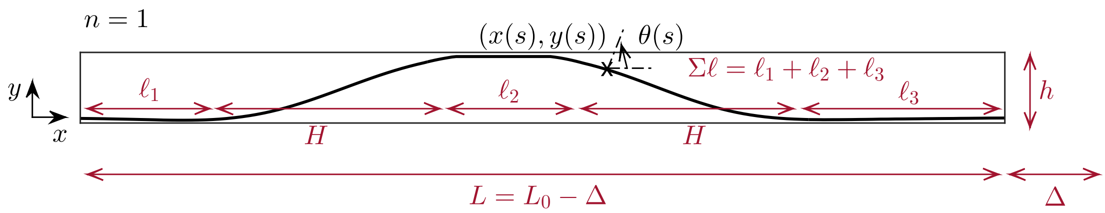

FIG. 1. Notations for a bi-laterally constrained elastic sheet: the sheet is parameterized by the local slope $\theta(s)$ of the centerline of a cross-section normal to the z direction at each curvilinear position $s \in [0, L_0]$, of cartesian coordinates $(x(s), y(s))$. L_0 is the total length of the sheet, Δ is the compression distance, $L = L_0 - \Delta$ is the horizontal distance, along the x axe, between the two opposite ends of the sheet, h is the vertical gap. $H = (L - \Sigma\,\ell)/2n$ is the projected length per free segment, while $\Sigma\,\ell$ is the total length of the line contacts (here $\Sigma\,\ell = \ell_1 + \ell_2 + \ell_3$).

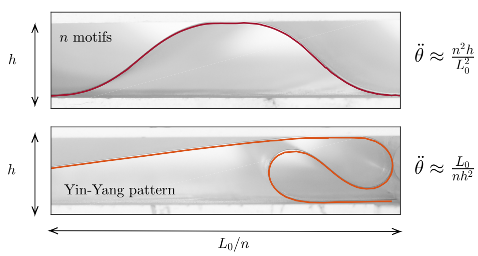

FIG. 2. Typical curvature $\ddot{\theta}$ for the two configurations: n motifs *versus* Yin-Yang pattern.