

Snap-back repellers in rational difference equations

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We are dealing with the existence of chaos, in the Li-Yorke sense, in rational difference equations. This problem arise, for example, when we apply the Newton's method to polynomials obtaining rational difference equations of order one.

In the paper we review ideas and results from Marotto in [1] based on a subtle study of the dynamics near a special kind of equilibrium (snap-back repeller). We find that some of them remain true in the non-continuous setting, for example in rational difference equations , and how some others can be proved via the introduction of an additional condition, what we call the *compact pre-image property*.

As applications, we estimate numerically the snap-back repellers of the families $x_{n+1} = \frac{1}{x_n^2 - c}$ (*inverse parabolas*) and $x_{n+1} = \frac{1}{rx_n(1-x_n)}$ (*inverse logistic equations*). Such estimations are obtained using the basins of attraction, in \mathbb{C} , of the reciprocal difference equations. Additionally we use them to estimate also *their forbidden sets*.

References

- [1] Marotto, Frederick R. *Snap-back repellers imply chaos in \mathbb{R}^n* , Mathematical Analysis and Applications, **63** (1978), 199–223.