Dynamics of root-finding methods

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We give an overview of root-finding methods of univariate polynomials and their interpretation as complex dynamical systems. The main focus is the Weierstrass/Durand–Kerner method and its similarities and differences to the Newton and the Ehrlich–Aberth methods.

In particular, we show how to use methods from computational algebraic geometry to investigate (and/or establish) the existence of attracting periodic cycles, as well as diverging orbits, and present explicit examples of both phenomena for the Weierstrass method.

Bernhard Reinke. Diverging orbits for the Ehrlich–Aberth and the Weierstrass root finders. Proc. Amer. Math. Soc. 150 (2022), 1287–1300 https ://doi.org/10.1090/proc/15715

Bernhard Reinke, Dierk Schleicher, and Michael Stoll. The Weierstrass–Durand–Kerner root finder is not generally convergent. Math. Comp. 92 (2023), 839–866 https ://doi.org/10.1090/mcom/3783

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