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ERRATUM TO "CHAOTIC POLYNOMIALS ON FRÉCHET SPACES"

ALFREDO PERIS

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In [3], Theorem 1 has an error, as pointed out to us by Andreas Braunss. The purpose of that paper was to show the existence of chaotic m-homogeneous polynomials on a Fréchet space. Theorem 1 asserts that the polynomial

$$P : \mathcal{H}(\mathbb{C}) \to \mathcal{H}(\mathbb{C}),\ (Pf)(z) := \sum_{j \geq 0} \frac{(f^{(j+1)}(0))^m}{j!} z^j, \quad z \in \mathbb{C},\ f \in \mathcal{H}(\mathbb{C}),$$

is well-defined. This is not true. Braunss' example [1] to show that P is not well-defined is this: The function $f(z) := \sum_{j \geq 0} \frac{j^{j/m}}{j!} z^j$ is entire, but Pf is not. The following replacement for Theorem 1 in [3] gives the existence of chaotic polynomials on the Fréchet space $\omega := \mathbb{C}^{\mathbb{N}}$.

Theorem 1. *For each m natural ($m \geq 2$) there exists a chaotic m-homogeneous polynomial $P : \omega \to \omega$.*

Let us define $P : \omega \to \omega$ by $(Px)_j := x_{j+1}^m$, $j \in \mathbb{N}$, for every $x = (x_j) \in \omega$. P is a continuous m-homogeneous polynomial. We first prove that P is hypercyclic. Indeed, select a sequence of eventually null elements of ω, $x(n) = (x(n)_1, \dots, x(n)_{j(n)}, 0, 0, \dots)$, $n \in \mathbb{N}$, which form a dense subset of ω. Then pick $k(0) := 0$, $k(n) := \sum_{i=1}^n j(i)$, $n \in \mathbb{N}$, and define x by

$$x_{k(n)+i}^{m^{k(n)}} = x(n+1)_i, \quad i = 1, \dots, j(n+1), \quad n \geq 0.$$

The definition of x gives that $(P^{k(n)}x)_i = x(n+1)_i$, $i = 1, \dots, j(n+1)$, $n \geq 0$, which yields the density of the orbit $\mathrm{Orb}(P, x)$ in ω. For the density of periodic points of P in ω, take $x(n)$ as before and define $y(n)$, $n \in \mathbb{N}$, by

$$y(n)_{kj(n)+i}^{m^{kj(n)}} = x(n)_i, \quad i = 1, \dots, j(n), \quad k \geq 0, \quad n \in \mathbb{N}.$$

Each $y(n)$ is $j(n)$-periodic for P and this sequence of periodic points is dense in ω since $y(n)_i = x(n)_i$, $i = 1, \dots, j(n)$, $n \in \mathbb{N}$. □

We generalize this result in [2] and show that many sequence and function spaces, as e.g. $\mathcal{H}(\mathbb{D})$, admit chaotic m-homogeneous polynomials. Examples of non-homogeneous chaotic polynomials on ℓ_p are presented in [4].

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Departamento de Matemática Aplicada, E. T. S. Arquitectura, Universidad Politécnica de Valencia, E-46022 Valencia, Spain

E-mail address: aperis@mat.upv.es