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Title: Linear iterative equations of higher orders and random-valued functions

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Given a probability space $(\Omega, \mathcal{A}, P)$, a separable metric space X with the σ-algebra $\mathcal{B}$ of all its Borel subsets and a $\mathcal{B} \otimes \mathcal{A}$-measurable $f : X \times \Omega \to X$ we consider the equation

$$\varphi(x) = \int_\Omega \varphi(f(x,\omega))P(d\omega) \tag{E}$$

and iterates $f^n, n \in \mathbb{N}$, of f defined on $X \times \Omega^{\mathbb{N}}$ by $f^1(x,\omega) = f(x,\omega_1)$ and $f^{n+1}(x,\omega) = f(f^n(x,\omega),\omega_{n+1})$. Assuming that for every $x \in X$ the sequence $(f^n(x,\cdot))_{n\in\mathbb{N}}$ converges in law and $\pi(x,\cdot)$ denotes the limit distribution we show that for every Borel and bounded $u : X \to \mathbb{R}$ the function $x \mapsto \int_X u(y)\pi(x,dy)$, $x \in X$, is a Borel solution of (E) and we study regularity of these solutions.

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