PERIODIC SOLUTIONS OF CONTINUOUS AND DISCRETIZED NON-LINEAR WEAKLY-SINGULAR VOLTERRA EQUATIONS WITH FINITE MEMORY

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We are motivated by the nonlinear Volterra integral equation

$$\mathsf{x}(t) = \int_{t-\tau}^{t} \mathsf{k}(t,s)\mathsf{f}(s,\mathsf{x}(s))\mathrm{d}s, \quad \text{for } t \in \mathbb{R} \text{ with } \tau > 0,\ \mathsf{x}(t) \in \mathbb{R}, \tag{1}$$

studied under certain conditions on $\mathsf{k}(\cdot,\cdot)$ and $\mathsf{f}(\cdot,\cdot)$ that ensure the existence of periodic solutions $\mathsf{x}(\cdot)$. When $\mathsf{k}(t,s)$ is continuous, it is possible to pick quadrature formulae so that the solutions of discretized version of (1), of the form

$$x(n) = \sum_{j=n-N}^{n} k(n,j)f(j,x(j)), \quad N \in \mathbb{N}, \quad x(n) \in \mathbb{R}, \tag{2}$$

have corresponding periodic solutions $x(\cdot)$. We show how such results can be extended to the case of a weakly-singular kernel k and a modified discretization.