COUPLED AND MIXED COUPLED HYBRID FIXED POINT PRINCIPLES IN A PARTIALLY ORDERED BANACH ALGEBRA AND PBVPS OF NONLINEAR COUPLED QUADRATIC DIFFERENTIAL EQUATIONS

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Abstract. In this paper we prove some coupled and mixed coupled hybrid fixed point theorems involving different algebraic combinations of three operators and coupled operators in a partially ordered Banach algebra by an application of a coupled hybrid fixed point principle for partially condensing coupled mappings developed in Dhage [J. Fixed Point Theory Appl. 19 (2017), 2541–2575]. Our approach is based on the partial Kuratowskii measure of noncompactness with maximum property and is somewhat different from the approach of coupled hybrid fixed point theorems presented in Dhage [J. Fixed Point Theory Appl. 19 (2017), 3231–3264]. We apply our newly developed abstract mixed coupled hybrid fixed point theorems along with algorithms to a couple of nonlinear first and second order coupled quadratically perturbed hybrid differential equations with the periodic boundary conditions for proving the existence and approximation theorems under certain mixed hybrid conditions from algebra, analysis and topology. The abstract existence and approximation results of the coupled quadratic periodic boundary value problems of first and second order ordinary differential equations are also illustrated by presenting a few numerical examples. We claim that the results of this paper are new to the literature on nonlinear analysis applications.


Keywords and phrases: Partially ordered Banach algebra, partial measure of noncompactness, Dhage monotone iteration principle, coupled hybrid fixed point theorem, coupled quadratic periodic boundary value problems, existence and approximation theorem.

REFERENCES


