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Asymptotically Bounded Multifunctions and the MCP beyond Copositivity

Given a multifunction $F : \mathbb{R}_+^n \rightrightarrows \mathbb{R}^n$ and $q \in \mathbb{R}^n$, the multivalued complementarity problem (MCP) on the positive orthant consists in finding

$$\bar{x} \geq 0, \bar{y} \in F(\bar{x}) : \bar{y} + q \geq 0, \langle \bar{y} + q, \bar{x} \rangle = 0.$$

Such a formulation appears in many applications in Science and Engineering and therefore was the object of many investigations in the last three decades. Most of the works existing in the literature deal with the case when F is pseudomonotone (in the Karamardian sense) or quasimonotone, and only a few assume copositivity. In this work we introduce the notion of asymptotic multifunction with respect to a class of re-scaling functions including those with slow growth, and the notion of asymptotic multifunction associated to a sequence of multifunctions rather to a single one. Based on these two concepts we establish new existence theorems for the MCP for a class of multifunctions larger than copositive without assuming positive (sub)homogeneity as in a previous work. In addition, some stability and sensitivity results, as well as a robustness property, are provided. Thus, in this regard, we unify and generalize some of the results previously established.

Keywords: Complementarity problem, copositive multifunction, asymptotically bounded multifunction, asymptotic analysis.

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