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Representation of Multivalued Maps

The problem of representation of set-valued mappings is solved in the framework of the lower semicontinuity.

“Let X, Y and Z be topological spaces, $f : X \times Y \to Z$ be a separately continuous single-valued function and $\Gamma : X \to 2^Z \backslash \{\emptyset\}$ be a set-valued mapping. Assume $f(x, Y) \cap \Gamma(x) \neq \emptyset$, $x \in X$. There exists a lower semicontinuous set-valued function $H : X \to 2^Y \backslash \{\emptyset\}$ such that

$$f(x, H(s)) \subseteq \Gamma(x), \quad x \in X\,?''$$

This question deals directly with the lower semicontinuity criteria for the regulation map in Control Theory and Viability Theory.

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