"LIMIT SOLUTIONS" FOR CONTROL SYSTEMS

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Abstract. For a control Cauchy problem

$$\dot{x} = f(t, x, u, v) + \sum_{\alpha=1}^{m} g_\alpha(x)\dot{u}_\alpha \quad x(a) = \bar{x},$$

on an interval $[a, b]$, we propose a notion of *limit solution* x that verifies the following properties: i) x is defined for $\mathcal{L}^1$ (impulsive) inputs u and for standard, bounded measurable, controls v; ii) in the commutative case (i.e. when $[g_\alpha, g_\beta] \equiv 0$, for all $\alpha, \beta = 1, \ldots, m$), x coincides with the solution constructed via multiple fields' rectification; iii) x subsumes former concepts of solution valid for the generic, noncommutative case. In particular, when u has bounded variation, we investigate the relation between limit solutions and (single-valued) graph completion solutions. Furthermore, we prove consistency with the classical Carathéodory solution when u and x are absolutely continuous. Some generalizations are under investigation, e.g. to the case where the dynamics is polynomial in $\dot{u}$.

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