

On the convergence of the virtual control concept for semilinear state constrained optimal control problems

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Abstract. We consider a semilinear optimal control problem with pointwise state constraints and control constraints. Problems of this type were discussed extensively in the recent past because of specific difficulties since the Lagrange multipliers associated with the state constraints are in general only regular Borel measures. Therefore, different regularization concepts are developed in the last years, e.g. a Moreau-Yosida type regularization or a Lavrentiev type method. Using the control for the Lavrentiev regularization concept can yield numerical difficulties, if the different constraints are active simultaneously. This leads to a nonuniqueness of the dual variables. Thus, we apply the virtual control concept, where an additional distributed control is introduced. This control acts in the cost functional and the semilinear state equation, and it is used for regularization of the state constraints. Hence, a separation for the active sets can be avoided. The convergence of optimal controls of the regularized problems is studied for different parameter functions and a regularization parameter tending to zero. This analysis is based on a second-order sufficient optimality condition for the original problem that is carried over to the regularized problems.