

On the Feasibility and Continuity of Feedback Controllers Defined by Multiple Control Barrier Functions

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Abstract: Control barrier functions are a popular method for encoding safety specifications for dynamic systems. In this paper, a notion of control barrier function is defined that permits vector-valued barrier functions and flow constraints involving both the state and control input. Control barrier functions induce constraints on the control input that, when satisfied, guarantee the forward invariance of the safe set. The constraints can be enforced using a pointwise-optimal feedback controller; sufficient conditions for the continuity of the controller are given. The existence of a control barrier function is defined to be equivalent to the feasibility of the optimal feedback controller. Polynomial optimization problems based on sums of squares are formulated that can be used to certify that a given function is a control barrier function.

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