Flatness by Pure Prolongation: Necessary and Sufficient Conditions

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Résumé

In this article, we introduce the notion of **differential flatness by pure prolongation**: loosely speaking, a system admits this property if, and only if, there exists a pure prolongation of finite order such that the prolonged system is feedback linearizable.
We obtain Lie-algebraic necessary and sufficient conditions for a general nonlinear multi-input system to satisfy this property.
These conditions are comprised of the involutivity and relative invariance of a pair of filtrations of distributions of vector fields. An algorithm computing the minimal prolongation lengths of the input channels that achieve the system linearization, yielding the associated flat outputs, is deduced. Examples that show the efficiency and computational tractability of the approach are then presented.

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