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【563】 Tensor and polynomial decompositions: making invariance and positivity explicit

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We develop a framework (based on a recently studied framework of tensor decompositions) to decompose multivariate polynomials into univariate polynomials in a general way, explicitly expressing the polynomial's invariance. If the polynomial is contained in some positivity cone (for example sum of squares polynomials), we introduce and characterise corresponding inherently positive decompositions. We show under which assumptions an invariant decomposition exists and provide explicit constructions for all cases. We prove that inherently positive decompositions can be arbitrarily more costly than unconstrained ones. Subsequently, we show that unconstrained decompositions cannot contain any computable local certificate of positivity for globally nonnegative polynomials by formulating an undecidable problem in this context.

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