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Depth and Regularity of Powers of Sums of Ideals

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Given arbitrary homogeneous ideals I and J in polynomial rings A and B over a field k, we investigate the depth and the Castelnuovo-Mumford regularity of powers of the sum $I + J$ in A $\otimes_k B$ in terms of those of I and J. Our results can be used to study the behavior of the depth and regularity functions of powers of an ideal. For instance, we show that such a depth function can take as its values any infinite non-increasing sequence of non-negative integers.