Tchebyshev triangulations of stable simplicial complexes

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Abstract

We generalize the notion of the Tchebyshev transform of a graded poset to a triangulation of an arbitrary simplicial complex in such a way that, at the level of the associated F-polynomials $\sum_j f_{j-1}((x-1)/2)^j$, the triangulation induces taking the Tchebyshev transform of the first kind. We also present a related multiset of simplicial complexes whose association induces taking the Tchebyshev transform of the second kind. Using the reverse implication of a theorem by Schelin we observe that the Tchebyshev transforms of Schur stable polynomials with real coefficients have interlaced real roots in the interval $(-1,1)$, and present ways to construct simplicial complexes with Schur stable F-polynomials. We show that the order complex of a Boolean algebra is Schur stable. Using and expanding the recently discovered relation between the derivative polynomials for tangent and secant and the Tchebyshev polynomials we prove that the roots of the corresponding pairs of derivative polynomials are all pure imaginary, of modulus at most one, and interlaced.

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