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Farid Alizadeh* (alizadeh@rutcor.rutgers.edu), 640 Bartholomew Rd, Piscataway, NJ 08854,
Gabor Rudolf (grudolf@rutcor.rutgers.edu), 640 Bartholomew Rd, Piscatawy, NJ 08854,
and **Nilay Noyan** (noyan@rutcor.rutgers.edu), 640 Bartholomew Rd, Piscataway, NJ 08854.

Bilinear complementary conditions for the cone of positive polynomials.

For a closed, convex and full-dimensional cone $\mathcal{K}$ in $\mathbb{R}^n$ and its dual cone $\mathcal{K}^*$ the complementary slackness condition $< x, s >= 0$ defines an n-dimensional manifold $C(\mathcal{K})$ in the space $\{(x,s) \mid x \in \mathcal{K}, s \in \mathcal{K}^*\}$. When $\mathcal{K}$ is a symmetric cone (that is a self-dual cone whose automorphism group acts transitively on its interior), this manifold can be described by a set of n bilinear equalities. This fact proves to be very useful when optimizing over such cones, therefore it is natural to look for similar optimality constraints for non-symmetric cones. In this talk we examine the cone of positive polynomials of degree $2n$, $\mathcal{P}$, and its dual, the moment cone $\mathcal{M}$. We show that there are exactly 4 linearly independent bilinear identities which hold for all (x,s) in $C(\mathcal{P})$, regardless of the dimension of the cones. We then establish similar results for the cone of positive polynomials over a finite interval and the cone of positive trigonometric polynomials. We will also present some examples of cones where our approach can be used to show that no non-trivial bilinear optimality constraints exist. (Received February 06, 2006)