Let $A$ denote an $n \times n$ unitarily irreducible complex matrix. Let $H_1$ and $iH_2$ be the hermitian and skew-hermitian parts of $A$, and define the polynomial $F_A(x, y, t) := \det (xH_1 + yH_2 + tI)$. We define $\Gamma_F : F(x, y, t) = 0$ in $\mathbb{P}^2(\mathbb{R})$, whose dual $\hat{\Gamma}_F$ is called the boundary generating curve. The convex hull of the latter is the numerical range of $A$, denoted $W(A)$. This process thus gives a method for going from $A$ to $W(A)$. Lax conjectured in 1958 that that we can also do the reverse: for a certain type of curve $C$, there exist symmetric matrices $B$ and $C$ for which $G(x, y, t) := \det (xB + yC + tI)$ satisfies $C = \hat{\Gamma}_G$. This conjecture was proved in 2005 by Lewis, Parrilo, and Ramana. In 2012, Helton and Spitkovsky completed the connection by proving that there exists a symmetric matrix $S$ for which $F_A = F_S$; in particular $W(A) = W(S)$. In this talk we give a concise proof of the following generalization: For any factor $g$ of $F_A$, there exists a symmetric matrix $T$ for which $F_T = g$. We will analyze examples of these factors and how the curves they define can intersect.

This is joint work with L. A. Deaett, T. Sendova, I.M. Spitkovsky, and R. Yates. (Received September 27, 2017)