

1011-15-179

**Jeffrey Stuart\*** ([jeffrey.stuart@plu.edu](mailto:jeffrey.stuart@plu.edu)), Mathematics Department, Pacific Lutheran University, Tacoma, WA 98447. *Ray Patterns, Determinants and Inversion.*

A sign pattern is a set consisting of all real matrices with a prescribed zero-nonzero pattern for which the signs of the nonzero entries are prescribed. A ray pattern is a set consisting of all complex matrices with a prescribed zero-nonzero patterns for which the complex arguments of the nonzero entries are prescribed.

It is well known that a fixed sign for the determinant is equivalent to invertibility for all matrices in a sign pattern. In contrast, a fixed ray for the determinant is sufficient but not necessary for the invertibility of all matrices in a ray pattern. There are invertible ray patterns for which every nonzero complex number occurs as a determinant of some matrix.

It is well-known that for an  $n \times n$  sign pattern, the maximum number of nonzeros is  $(n^2 + 3n - 2) / 2$ , and there are constructions for such sign patterns. For complex ray patterns, less is known although it has been shown that there are full  $n \times n$  patterns for  $n \leq 4$ , and that there does not exist such a pattern for  $n \geq 5$ .

We present weaker determinantal sufficiency conditions for invertibility and relate them to a construction of ray patterns that guarantee invertibility and that contain at least  $(n^2 + 3n - 2) / 2$  nonzero entries. (Received August 25, 2005)