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Webs in Grassmann Cells

The aim of this talk is to establish a relationship between the totally non-negative part of a Grassmannian and the planar oriented networks. These networks can be thought of as semiconductor networks composed of transistors. We solve the inverse boundary problem for these networks. Simply speaking, we answer the question: "To which extent and how can we identify a network by boundary measurements?" The construction leads to a description of parametrizations of the totally nonnegative Grassmannian. The combinatorial types of networks produce a cellular decomposition of the totally nonnegative Grassmannian. The cells are the intersections of the matroid strata on the Grassmannian with its totally nonnegative part. They correspond to the matroids that can be realized by real matrices with nonnegative maximal minors. We give several interesting combinatorial description for such matroids. This theory generalizes the results of Fomin and Zelevinsky on type A double Bruhat cells.