Systems of Parallel Representatives in Finite Affine Planes

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In a finite affine plane of order n, a *system of parallel representatives* (SPR) is a set of $n + 1$ lines consisting of exactly one line from each parallel class of the plane. An SPR A is *tight* if no three lines in A are incident on a common point; this is equivalent to a hyperoval in the dual of the associated projective plane of order n. We describe some basic properties of SPR's and characterize tight SPR's as those on which a certain sum-of-squares function attains the value 0. We then examine some necessary conditions for an SPR to be minimal with respect to this function, and look at applications of our results in affine planes of small order.

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