THE CROSSING NUMBER OF A PROJECTIVE GRAPH IS QUADRATIC IN THE FACE–WIDTH

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We show that for each integer $g \geq 0$ there is a constant $c_g > 0$ such that every graph that embeds in the projective plane with sufficiently large face–width r has crossing number at least $c_g r^2$ in the orientable surface Σ_g of genus g (where Σ_0 is the ordinary plane). As a corollary, we give a polynomial time constant factor approximation algorithm for the crossing number of projective graphs with bounded degree.