

Closed Formulae for interference and distance problems involving ellipses and ellipsoids

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By using several tools coming from Real Algebraic Geometry and Computer Algebra a new condition for the separation of two ellipsoids in three-dimensional Euclidean space and a new formula for the distance between two ellipses are introduced.

The separation formulae for two ellipsoids is characterized by a small set of equalities and inequalities depending only on the entries of the matrices defining the two considered ellipsoids and does not require in advance the computation (or knowledge) of the intersection points between them. Moreover, this characterization, involving only six polynomials, is specially well adapted for computationally treating the case where the considered ellipsoids depend on one or several parameters.

The provided formula for the distance between two ellipses is derived from the one for the distance between a given point and one ellipse, completely independent of footpoints. This formula is then used to analyze the ellipses moving problem.

In both cases, specific techniques for dealing with the big involved expressions when rational motions are involved are required.

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