A constructive educational approach to conics and quadrics allowed by the arrival of 3D-DGS

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Abstract:

Conics and quadrics are usually treated at Mathematics, Sciences and Engineering Schools. The availability of 3D Dynamic Geometry Systems (3D-DGS) with algebraic capabilites allows to introduce both of them in an attractive way. The different conics can be obtained (and viewed) as sections of a right circular cone ("Apollonius cone"). Allocating conveniently the cone allows a 3D-DGS to directly obtain the implicit equations of the conics [1]. Moreover, both degenerate and non-degenerate quadrics of revolution can be obtained (and plotted) in a constructive way too, as usually done for conics in 2D-DGS. For instance, an ellipsoid of revolution is the locus of points such that the sum of distances to the two foci is constant. Again, the implicit equations of the quadrics of revolution can be directly obtained by the 3D-DGS [2].

References:

[1] E. Roanes-Lozano. A Brief Note on the Approach to the Conic Sections of a Right Circular Cone from Dynamic Geometry. Mathematics in Computer Science 11/3-4 (2017) 439-448. DOI: 10.1007/s11786-017-0307-3

[2] E. Roanes-Lozano. A constructive approach to the quadrics of revolution using 3D dynamic geometry systems with algebraic capabilities. Computer Applications in Engineering Education 25 (2017) 26-38. DOI: 10.1002/cae.21775