14th International Conference on Geometry and Graphics
August 5-9, 2010, Kyoto ISBN 978-4-9900967-1-7

FROM THE DESCRIPTIVE GEOMETRY TO THE INFORMATICS LANGUAGE

Francesco DI PAOLA and Maria Rita PIZZURRO
University of Palermo, Italy

This study is centred in the environment of the research into solutions of the problems of graphic representation, expressing theoretical considerations which allow the carrying out of geometric-descriptive procedures decoded in informatics language, for implementing *CAD* commands. From our didactic experiences, matured within the Design course given at the Engineering Faculty of the University of Palermo, we have ascertained that the use of the informatics tool is a valid technical aid for the comprehension and the critical analysis of the geometric figures in three dimensional space. Emerged the need to introduce, within the *CAD* software, commands with new functions with the goal of simplifying descriptive geometry and projective applications. Focusing our attention on the *AutoCAD* software today it is possible to design only ellipse conic, if the coordinates of the axes end points are known; but it is not possible to draw conics (ellipse, parabola, hyperbola) in which two conjugate diameters are known, or one diameter and a conjugate chord, or two conjugate chords, or five elements amongst points and tangents; these conditions are very frequent in the applications of the different methods of representation. Our research intends to translate into programming language *AutoLISP*, the algorithm of descriptive and projective geometry[1]. In this paper we report the translation of an algorithm of the construction of an conic from its five known points with projective and homological process[2]. We proposes an application in architecture, aimed to underline the operative advantages of the *CAD* function created for the fast and rigorous resolution of graphic problems, linked to the general construction of conics. The discussed example is referred to a perspective to a horizontal picture plane representation of a Roman cross vault on a square plant with a springer plane coincident with the π picture plane. An opportune position of the center of projection V assigned, the perspective image of the circular directrix of the two equal cylinders -belonging to planes perpendicular to the π picture plane, passing for the sides of the springer plane- and of the diagonal ellipses -intersections of the two cylinders- it can respectively be an ellipse, a parabola or an hyperbole in relationship to the position of these planed curves in comparison to limit plane[3] respectively, external, tangent or secant plane to the cylinders with circular section. For the geometric construction of the conics it is enough to determine, employing resolute methods for the affine orthogonal homology and with a proper center, only five points of these conics to immediately describe in *AutoCAD* software, with the elaborate algorithm (function "CONIC5"), the searched profiles. (Fig.1).

Keywords: programming language *AutoLISP*, descriptive geometry, representation of conics.

[1] Di Paola, F. - Pizzurro, M.R. *Informatics in Descriptive Geometry (Didactic Experience)*, G – *Slovak Journal for Geometry and Graphics*, Bratislava: Slovak Society for Geometry and Graphics, SSGG, Vol. 6 No. 12, ISSN 1336-524X, pp.17-30 (in Slovak) (2009).

[2] Inzerillo, M. *Fondamenti e Applicazioni di Scienza della Rappresentazione – Geometria del Disegno – PROSPETTIVA*. (Graphic design and layout, Francesco Di Paola), Michele Inzerillo, Palermo, ISBN 978-88-903908-0-7 (2008).

[3] Sklenáriková, Z. *One hundred years since death of Karl Pelz*, G – *Slovak Journal for Geometry and Graphics*, Bratislava: Slovak Society for Geometry and Graphics, ISSN 1336-524X, Volume 5 No. 9, pp. 31-44 (in Slovak) (2008).

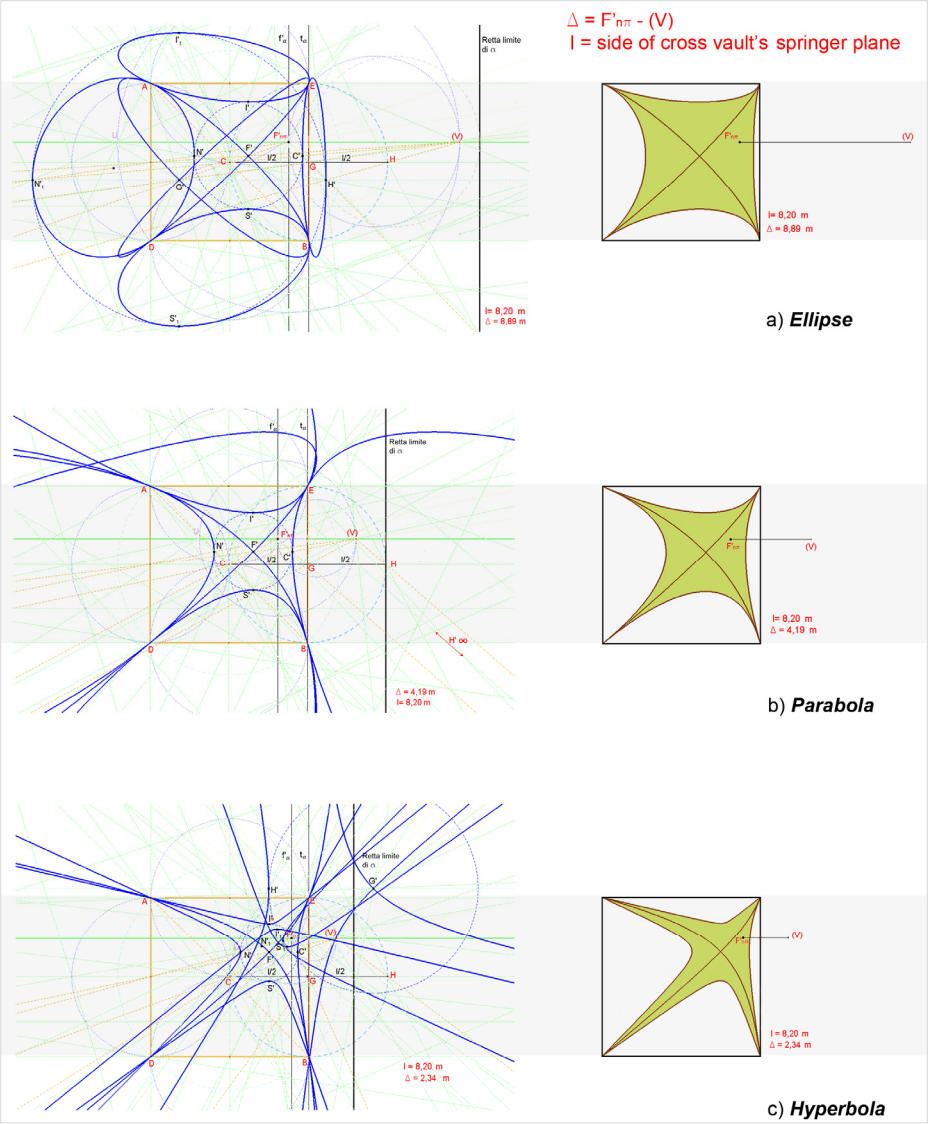

Fig. 1 – One example of the application of the function "CONIC5" in *AutoCAD* software to the representation of a Roman cross vault on a square plant. Perspective to a horizontal picture plane representation of with a springer plane coincident with the π picture plane. The perspective image can respectively be an ellipse (**a**), a parabola (**b**) or an hyperbole (**c**) in relationship to the position of the circular directrix of the vault's two equal semi-cylinders, in comparison to limit plane.

---

[1] Using procedures and methods proposed by the most illustrious treatisers of the Science of Representation for the construction of conics (A.F. Frézier, M. Chasles, K. Pelz, J.V. Poncelet, J. Steiner).

[2] Description of the process: Given five pints of conic, with a previous choice of the these position, two couplet of chords are realized. From these two diametrical direction are found; to determinate the centre, a diameter and a tangent we proceed homologically.

[3] The parallel plane to π passing for the centre of projection V is the limit plane.