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METHODS FOR SIMPLIFYING THE GENERAL EQUATION OF SECOND-ORDER LINES

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Abstract : This in the article second orderly of lines general equation simplification methods analysis The line is drawn type looking at equation canonical to form to bring , to fit coordinate to the children transition and to the center according to classification methods seeing Also , simplification in the process used algebraic and geometric methods , their application and results in detail will be covered . Article second orderly the lines research in doing important theoretical the basics and practical to applications related recommendations own inside takes .

Key words : second orderly lines , general equation , simplification methods , canonical shape , coordinates replace , center find , algebraic methods , geometric classification .

Second orderly lines , that is cones intersections , geometry , algebra and practical in mathematics important role plays [1-5] . Their general equation quadratic , linear terms and permanent the value own inside takes , this and classification and analysis to do process complicates . This the lines to study facilitate for the purpose various simplification methods working issued are , they are general equation more comfortable to form to bring opportunity gives . Such methods in line coordinates change , quadratic the form diagonalization and equation canonical to form to bring This techniques application through second orderly of lines geometric properties determination and classification becomes easier [5-6]. This in the article general equation simplification methods , their mathematician basics and practical application analysis will be done .

We are as is known second orderly curve of the line general appearance

$$a_{11}x^2 + 2a_{12}xy + a_{22}y^2 + 2a_{13}x + 2a_{23}y + a_{33} = 0$$

In this way, to determine and construct a second-order line given in this form, it can be classified according to whether or not it has a center.

Simplify a second-order linear equation with a single center .

In this case, using parallel translation, we place the coordinate origin at the center of the second-order line. As a result, the first terms in the equation disappear. We direct the coordinate axes along mutually perpendicular principal directions. Since the mutual addition of directions is an invariant property, in the new coordinate system $\{1,0\}$ and $\{0,1\}$ directions are mutually complementary. This condition

$$a_{12} = 0$$

is equal to the equality. So in this case the equation of the second-order line is

$$a_{11}x^2 + a_{22}y^2 + a_{33} = 0 \quad (1)$$

In this equation a_{11} 0 a_{22} 0 , a_{33} the coefficient may or may not be zero. If a_{33} the coefficient is zero, then equation (1)

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$Ax^2 + By^2 = 0$ (2)

If A, B the coefficients have different signs, this equation defines two intersecting straight lines. If the coefficients have the same signs, this equation defines a single point.

If the coefficient in equation (1) above is not equal to zero, then equation (2) a_{33}

$Ax^2 + By^2 = 1$ (3)

This equation determines an ellipse or a hyperbola, depending on the sign of the coefficients. Thus, a second-order line with a single center consists of one of the following four lines:

1. Ellipse
2. hyperbole;
3. two intersecting straight lines;
4. one point.

Simplify a second-order linear equation without a single center .

We then orient the new ordinate axis along a non-special principal direction. We know that this direction is non-asymptotic. We take the diameter of the axis of the ordinate as the abscissa. In the new coordinate system, the direction of the ordinate axis is $\{0,1\}$ coordinates and the equation of the joint diameter in this direction

$$a_{12}x + a_{22}y + a_{23} = 0$$

This equation is $y = 0$ equivalent to the equation

$$a_{12} = 0 \quad a_{23} = 0 \quad a_{22} \quad 0$$

we get relationships. Furthermore

$$\delta = a_{11}a_{22} - a_{12}^2 = 0$$

If we take into account the equality $a_{11} = 0$, we get: The result is a second-order equation of a line without a single center.

$$a_{22}y^2 + 2a_{13}x^2 + a_{33} = 0 \qquad (4)$$

equation $a_{22} \quad 0$ is relevant. For this line,

$$\Delta = \begin{vmatrix} 0 & 0 & a_{13} \\ 0 & a_{22} & 0 \\ a_{31} & 0 & a_{33} \end{vmatrix} = -a_{22}a_{13}^2$$

Since , if , $a_{13} \quad 0$ then the second-order line has no center, and if $a_{13} = 0$, then the second-order line has infinitely many centers and the centers form a straight line.

If the second-order line does not have a center, then in equation (4) above $a_{13} \quad 0$, the second-order line $x = -\frac{a_{33}}{2a_{13}}$ intersects the abscissa axis at a point. We move the origin to this point and solve the equation

$$a_{22}y^2 + 2a_{13}x = 0 \qquad (5)$$

In this equation, if a_{13} the sign of the coefficient a_{22} is opposite to the sign of the coefficient, then equation (5)

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$y^2 = 2px$ (6)

It appears. $p > 0$ Since it is in this equation, it defines a parabola.

If a_{13} coefficient sign a_{22} If the coefficient sign is the same as in equation (6), $p < 0$ Since , it defines the empty set.

in equation (5) of a second-order line without a single center a_{13} is zero, then equation (4)

$a_{22} y^2 + a_{33} = 0$ (7)

In this equation a_{22} 0 , a_{33} the coefficient may or may not be zero. If a_{33} and if the coefficient is zero, equation (7)

$y^2 = 0$ (8)

appears and identifies two overlapping straight lines.

in equation (7) above a_{33} is not zero, then equation (7)

$y^2 = c$ (9)

If a_{33} the sign of the coefficient a_{22} 0 is opposite to the sign of the coefficient, then equation (9) $c > 0$ is in and it defines two parallel straight lines. If a_{33} the sign of the coefficient a_{22} 0 is the same as the sign of the coefficient, then equation (9) $c < 0$ is in and it defines the empty set.

Therefore, a second-order line without a unique center consists of one of the following three lines:

1) parabola (has no center);
2) two parallel straight lines (centers have a straight line);
3) two overlapping straight lines (centers have a straight line).

Second orderly of lines general equation simplification their geometric properties understanding and practical application for important importance has . Coordinates change , center determination and canonical to form to bring such as methods using complicated equations systematic accordingly analysis to be done and classification This is possible . techniques not only cones sections to study simplifies , but their physics , engineering and computer graphics such as in the fields also help with the application gives . See . issued methods this to the topic related next research and scientific and technological developments for solid theoretical basis become service does .

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