Tutorial Note for Math2012E

May 23, 2016

1 Cylinders and Quadratic surfaces

1.1 Cylinders

- Generated by moving a plane curve along a straight line.

- The curve is called generating curve for the cylinder.

- Equation for cylinder
  Let $F(\vec{x}) = 0$ be the plane curve, $\vec{v}$ be the direction vetor of the straight line, then we have the equation of cylinder

$$F(\vec{x} - t\vec{v}) = 0$$

1.2 Quadratic surface

- General equation

$$\text{General}: Ax^2 + B^y + Cz^2 + Dxy + Exz + Fyz + Gx + Hy + Iz + J = 0$$
$$\text{with } A, B, \ldots, J \text{ fixed constants.}$$
$$\text{Use matrix}: X^T A X + X^T B + C = 0$$
$$\text{with } A \text{ symmetric matrix}, B \text{ vector}, C \text{ constant}$$

- Transform the equation into simple one

  - Use orthogonal change of coordinate to eliminate the cross-terms
  - Use translation to eliminate the first order term

- Classification of basic quadartic surfaces cf. Tutorial class

- Additional problem: In the discusion of classification of quadratic surfaces, in case $D = 0$, why I don't talk about the case of $\lambda_1 > 0, \lambda_2, \lambda_3 < 0$? (There will be extra points for additional problems in the final mark.)

2 Problems

cf. Chapter 12 : Additional and Advanced Exercises 17-25

- Dot product is positive definite i.e. $\vec{u} \cdot \vec{y} \geq 0, \forall \vec{u}$

- triangle inequality
$$|\vec{u} + \vec{v}| \leq |\vec{u}| + |\vec{v}|$$

- In general, this extends to Hilbert space and defines a metric