Lecture 20 Activity Results for Test Student

Score for this attempt: **1** out of 1
Submitted Mar 14 at 8:21am
This attempt took 2 minutes.

Question 1

1 / 1 pts

Consider the second order differential operator *L*:

$$L(u) \equiv a(x,y)u_{xx} + 2b(x,y)u_{xy} + c(x,y)u_{yy}. \\ + d(x,y)u_x + e(x,y)u_y + f(x,y)u$$

Its discriminant is $\delta(x,y) = \big(b(x,y)\big)^2 - a(x,y)c(x,y)$.

Suppose $\delta(x,y) < 0$ at (x, y). Which statement below is true?

- Operator *L* is hyperbolic at (x, y).
- Operator *L* is parabolic at (x, y).
- Correct! Operator *L* is elliptic at (x, y).
- There is not enough information to determine the classification of operator *L* at (x, y). The classification is affected by coefficients *d*(x, y) and *e*(x, y).
- Operator *L* is degenerate at (x, y).

Additional Comments:

Question 2

0 / 0 pts

Consider the second order differential operator *L*:

$$L(u) \equiv a(x,y)u_{xx} + 2b(x,y)u_{xy} + c(x,y)u_{yy}. \\ + d(x,y)u_x + e(x,y)u_y + f(x,y)u$$

Suppose $\delta(x,y) = -\det\begin{pmatrix} a(x,y) & b(x,y) \\ b(x,y) & c(x,y)\end{pmatrix} = 0$ in a region of (x, y) and *a*(x, y), b(x, y) and c(x, y) are not all zeros.

What is the coefficient matrix of the canonical form?

- $\tilde{A}(\xi,\eta) = \alpha(\xi,\eta)\begin{pmatrix} 1 & 0 \\ 0 & -1\end{pmatrix}$
- $\tilde{A}(\xi,\eta) = \alpha(\xi,\eta)\begin{pmatrix} 0 & \frac{1}{2} \\ \frac{1}{2} & 0\end{pmatrix}$
- $\tilde{A}(\xi,\eta) = \alpha(\xi,\eta)\begin{pmatrix} 1 & 1 \\ 1 & 1\end{pmatrix}$
- Correct! $\tilde{A}(\xi,\eta) = \alpha(\xi,\eta)\begin{pmatrix} 1 & 0 \\ 0 & 0\end{pmatrix}$
- $\tilde{A}(\xi,\eta) = \alpha(\xi,\eta)\begin{pmatrix} 1 & 0 \\ 0 & 1\end{pmatrix}$

Additional Comments:

Question 3

0 / 0 pts

Consider the second order differential operator *L*:

$$L(u) \equiv a(x,y)u_{xx} + 2b(x,y)u_{xy} + c(x,y)u_{yy}. \\ + d(x,y)u_x + e(x,y)u_y + f(x,y)u$$

After a change of variable $\begin{cases} \xi = \xi(x,y) \\ \eta = \eta(x,y)\end{cases}$, the coefficient matrix is $\tilde{A}(\xi,\eta) = \frac{\partial(\xi,\eta)}{\partial(x,y)}A(x,y)\left(\frac{\partial(\xi,\eta)}{\partial(x,y)}\right)^T$.

Suppose $\delta(x,y) < 0$ in a region of (x, y). How do we transform operator *L* to its canonical form?

- We need to make $\tilde{A}_{12}(\xi,\eta) = 0$ and $\tilde{A}_{11}(\xi,\eta) = -\tilde{A}_{22}(\xi,\eta)$
- We need to make $\tilde{A}_{11}(\xi,\eta) = 0$ and $\tilde{A}_{22}(\xi,\eta) = 0$.
- We need to make $\tilde{A}_{11}(\xi,\eta) = \tilde{A}_{12}(\xi,\eta) = \tilde{A}_{21}(\xi,\eta) = \tilde{A}_{22}(\xi,\eta)$.
- We need to make $\tilde{A}_{22}(\xi,\eta) = 0$
- Correct! We need to make $\tilde{A}_{12}(\xi,\eta) = 0$ and $\tilde{A}_{11}(\xi,\eta) = \tilde{A}_{22}(\xi,\eta)$

Additional Comments:

Question 4

0 / 0 pts

Consider the second order differential operator *L*:

$$L(u) \equiv a(x,y)u_{xx} + 2b(x,y)u_{xy} + c(x,y)u_{yy}. \\ + d(x,y)u_x + e(x,y)u_y + f(x,y)u$$

After a change of variable $\begin{cases} \xi = \xi(x,y) \\ \eta = \eta(x,y)\end{cases}$, the coefficient matrix is $\tilde{A}(\xi,\eta) = \frac{\partial(\xi,\eta)}{\partial(x,y)}A(x,y)\left(\frac{\partial(\xi,\eta)}{\partial(x,y)}\right)^T$.

Suppose $\delta(x,y) > 0$ in a region of (x, y). How do we transform operator *L* to its canonical form?

- We need to make $\tilde{A}_{12}(\xi,\eta) = 0$ and $\tilde{A}_{11}(\xi,\eta) = -\tilde{A}_{22}(\xi,\eta)$
- Correct! We need to make $\tilde{A}_{11}(\xi,\eta) = 0$ and $\tilde{A}_{22}(\xi,\eta) = 0$.
- We need to make $\tilde{A}_{11}(\xi,\eta) = \tilde{A}_{12}(\xi,\eta) = \tilde{A}_{21}(\xi,\eta) = \tilde{A}_{22}(\xi,\eta)$.
- We need to make $\tilde{A}_{22}(\xi,\eta) = 0$
- We need to make $\tilde{A}_{12}(\xi,\eta) = 0$ and $\tilde{A}_{11}(\xi,\eta) = \tilde{A}_{22}(\xi,\eta)$

Additional Comments:

Question 5

0 / 0 pts

Consider the second order differential operator *L*:

$$L(u) \equiv a(x,y)u_{xx} + 2b(x,y)u_{xy} + c(x,y)u_{yy}. \\ + d(x,y)u_x + e(x,y)u_y + f(x,y)u$$

After a change of variable $\begin{cases} \xi = \xi(x,y) \\ \eta = \eta(x,y)\end{cases}$, the coefficient matrix is $\tilde{A}(\xi,\eta) = \frac{\partial(\xi,\eta)}{\partial(x,y)}A(x,y)\left(\frac{\partial(\xi,\eta)}{\partial(x,y)}\right)^T$.

Suppose $\delta(x,y) = 0$ in a region of (x, y). How do we transform operator *L* to its canonical form?

- We need to make $\tilde{A}_{12}(\xi,\eta) = 0$ and $\tilde{A}_{11}(\xi,\eta) = -\tilde{A}_{22}(\xi,\eta)$
- We need to make $\tilde{A}_{11}(\xi,\eta) = 0$ and $\tilde{A}_{22}(\xi,\eta) = 0$.
- We need to make $\tilde{A}_{11}(\xi,\eta) = \tilde{A}_{12}(\xi,\eta) = \tilde{A}_{21}(\xi,\eta) = \tilde{A}_{22}(\xi,\eta)$.
- Correct! We need to make $\tilde{A}_{22}(\xi,\eta) = 0$
- We need to make $\tilde{A}_{12}(\xi,\eta) = 0$ and $\tilde{A}_{11}(\xi,\eta) = \tilde{A}_{22}(\xi,\eta)$

Additional Comments:

Question 6

0 / 0 pts

Consider the differential equation

$a\xi_x^2 + 2b\xi_x\xi_y + c\xi_y^2 = 0.$

Suppose $a \neq 0$ and $b^2 - ac > 0$.

Which statement below is true.

- Correct! $a\xi_x^2 + 2b\xi_x\xi_y + c\xi_y^2 = 0$ can be written as a product of two real factors: $(\xi_x - \lambda_1\xi_y)(\xi_x - \lambda_2\xi_y) = 0$ where λ_1 and λ_2 are real roots of $a\lambda^2 + 2b\lambda + c = 0$.
- $a\xi_x^2 + 2b\xi_x\xi_y + c\xi_y^2 = 0$ can be written as a product of two complex factors: $(\xi_x - \lambda\xi_y)(\xi_x - \bar{\lambda}\xi_y) = 0$ where λ and $\bar{\lambda}$ are a pair of complex conjugate roots of $a\lambda^2 + 2b\lambda + c = 0$.
- $a\xi_x^2 + 2b\xi_x\xi_y + c\xi_y^2 = 0$ can be written as a complete square: $(\xi_x - \lambda\xi_y)^2 = 0$ where λ is the double root of $a\lambda^2 + 2b\lambda + c = 0$.
- Equation $a\xi_x^2 + 2b\xi_x\xi_y + c\xi_y^2 = 0$ cannot be factored.

Additional Comments:

Question 7

0 / 0 pts

Consider the differential equation

$a\xi_x^2 + 2b\xi_x\xi_y + c\xi_y^2 = 0.$

Suppose $a \neq 0$ and $b^2 - ac < 0$.

Which statement below is true.

- $a\xi_x^2 + 2b\xi_x\xi_y + c\xi_y^2 = 0$ can be written as a product of two real factors: $(\xi_x - \lambda_1\xi_y)(\xi_x - \lambda_2\xi_y) = 0$ where λ_1 and λ_2 are real roots of $a\lambda^2 + 2b\lambda + c = 0$.
- Correct! $a\xi_x^2 + 2b\xi_x\xi_y + c\xi_y^2 = 0$ can be written as a product of two complex factors: $(\xi_x - \lambda\xi_y)(\xi_x - \bar{\lambda}\xi_y) = 0$ where λ and $\bar{\lambda}$ are a pair of complex conjugate roots of $a\lambda^2 + 2b\lambda + c = 0$.
- $a\xi_x^2 + 2b\xi_x\xi_y + c\xi_y^2 = 0$ can be written as a complete square: $(\xi_x - \lambda\xi_y)^2 = 0$ where λ is the double root of $a\lambda^2 + 2b\lambda + c = 0$.
- Equation $a\xi_x^2 + 2b\xi_x\xi_y + c\xi_y^2 = 0$ cannot be factored.

Additional Comments:

Question 8

0 / 0 pts

Suppose the differential equation $a\xi_x^2 + 2b\xi_x\xi_y + c\xi_y^2 = 0$ can be factored into $(\xi_x - \lambda_1\xi_y)(\xi_x - \lambda_2\xi_y) = 0$.

Which of the following is true. **Select all that apply.**

- A solution of $a\xi_x^2 + 2b\xi_x\xi_y + c\xi_y^2 = 0$ must satisfy $(\xi_x - \lambda_1\xi_y) = 0$.
- A solution of $a\xi_x^2 + 2b\xi_x\xi_y + c\xi_y^2 = 0$ must satisfy $(\xi_x - \lambda_2\xi_y) = 0$.
- A solution of $a\xi_x^2 + 2b\xi_x\xi_y + c\xi_y^2 = 0$ must satisfy both $(\xi_x - \lambda_1\xi_y) = 0$ and $(\xi_x - \lambda_2\xi_y) = 0$.
- Correct! A solution of $(\xi_x - \lambda_1\xi_y) = 0$ must satisfy $a\xi_x^2 + 2b\xi_x\xi_y + c\xi_y^2 = 0$.
- Correct! A solution of $(\xi_x - \lambda_2\xi_y) = 0$ must satisfy $a\xi_x^2 + 2b\xi_x\xi_y + c\xi_y^2 = 0$.
- A solution of $a\xi_x^2 + 2b\xi_x\xi_y + c\xi_y^2 = 0$ may satisfy neither $(\xi_x - \lambda_1\xi_y) = 0$ nor $(\xi_x - \lambda_2\xi_y) = 0$.

Additional Comments:

Fudge Points: --

You can manually adjust the score by adding positive or negative points to this box.

Final Score: 1 out of 1

Update Scores

Here's the latest quiz results for Test Student. You can modify the points for any question and add more comments, then click "Update Scores" at the bottom of the page.

Quiz Submissions

Attempt 1: 1

Test Student has 1 attempt left

Allow this student an extra attempt

← Back to Quiz