

# Charateristics and solvability conditions

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## 1. Charateristics in $(x, y)$ plane

$$\frac{dx}{dt} = a \quad (1)$$

$$\frac{dy}{dt} = b \quad (2)$$

$$(3)$$

## 2. Charateristics in $(x, y, z)$ frame

$$\frac{dx}{dt} = a \quad (4)$$

$$\frac{dy}{dt} = b \quad (5)$$

$$\frac{du}{dt} = c \quad (6)$$

$$(7)$$

## 3. Solvability condition for quasi-linear first order PDE

$$ay'(s) - bx'(s) \neq 0$$

## 4. Charateristics strip in $(x, y, z)$ frame

$$\frac{dx}{dt} = F_p, x(0, s) = x_0(s) \quad (8)$$

$$\frac{dy}{dt} = F_q, x(0, s) = y_0(s) \quad (9)$$

$$\frac{du}{dt} = pF_p + qF_q, u(0, s) = u_0(s) \quad (10)$$

$$\frac{dp}{dt} = -F_x - F_u p, p(0, s) = p_0(s) \quad (11)$$

$$\frac{dq}{dt} = -F_y - F_u q, q(0, s) = q_0(s) \quad (12)$$

$$(13)$$

## 5. Solvability condition for general nonlinear first order PDE

$$F_q y'(s) - F_p x'(s) \neq 0$$

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