

Derivation of basic equations from physical laws

List 1 (16.01.2018)

Deadline — 6.02.2017.

1. Thread of length l is in vertical position, its upper end is fixed. Derive the equation for the small transverse oscillations of the thread.
2. Derive the equation for the transverse oscillations of a string in a medium whose resistance is proportional to the first power of the velocity.
3. Derive the diffusion equation in a stationary medium for a substance whose particles
 - a) decay at a rate proportional to the concentration;
 - b) multiply at a rate proportional to the concentration.

Characteristics and Canonical Forms of PDE

List 2 (23.01.2018)

Deadline — 6.02.2017.

1. Find all the characteristics of the equation $u_{xx} - y^2 u_{yy} = 0$ such that they contain the point
 - (a) $(1, 2)$;
 - (b) $(1, 0)$.
2. (a) Describe the characteristics of the equation

$$u_{xy} - u_{yy} - u_x + u_y = 0.$$

- (b) Find its general solution.