**Partial differential equations**

**Homework**

**Task 14. Inverse problems**

Below is a description of the problems of mathematical physics

**Variants**

1. The process of diffusion in a given one-dimensional region is considered. The initial concentration of the substance is known. At the left end of the body, the concentration and diffusion flux are set. There is no information on the right end. Additionally, the concentration is known at three fixed points over a certain time interval.

2. The process of string vibration is considered. The initial position of the string is known, but the initial velocity is not. The left end of the string moves according to a given law. The law of movement of the right end of the string is unknown. Additionally, the position of the string at a fixed time is known.

3. The process of heat transfer in a given one-dimensional region is considered. At the left end, the heat flux is known, and at the right, the law of temperature change. The initial body temperature is known. The unknown is the thermal conductivity coefficient. Additionally, the law of temperature change at some internal point is known.

**Steps of the task**

1. Give the formulation of the direct problem with an indication of the unknown quantities included in it.

2. Give a complete statement of the corresponding inverse problem.

3. Reduce the inverse problem to the corresponding optimization problem by determining the minimized functional with an indication of its arguments.

Use the examples of lecture as samples.