Laboratory Work № 3.35

Electrostatic field, its experimental exploration using modeling methodic.

Accessory: a bathtub partly filled with water, some different-shaped electrodes, source of supply, a voltmeter, pantograph with a probe, scaled ruler.

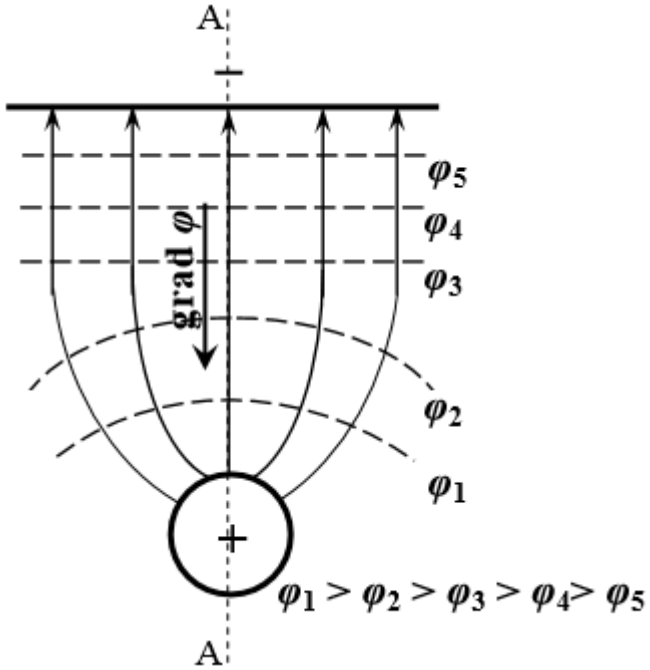
The aim: to explore electrostatic field in a model method.

Description of the device and piece of theory

For characterizing electrostatic field at any point of space intensity vector of the field $\vec{E}$ and the potential φ are used. The ratio is:

$$\vec{E} = -grad\varphi .$$

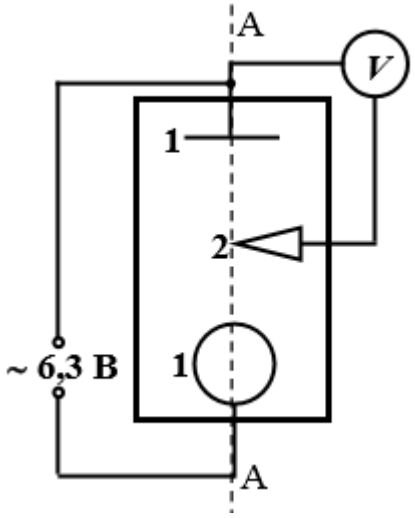
If we know disposition of the lines with equal potential, it's easy to sign strength lines of the field (this lines are perpendicular to the equipotential ones in cross-points).



Usually, electrodes' geometrical displacement is too complex to define equipotential lines in an analytic way. In this case, devices, which allow us to sign equipotential lines (based on analogy of disposition of electrical potential and disposition of the proper value in the device's system), are widely used. So, exploration of the electrostatic field is changed by investigation of its model-electric field of DC in a low conducting space between electrodes of the same shapes and displacement. In such a circumscription the field has the same configuration as it would have in vacuum. Thus, electrostatic field in vacuum and DC field in homogeneous circumscription are similar: both of them are potential and their strength lines are perpendicular to the electrodes' surface. Exploration of the potential disposition is completed with probe method.

Experimental gear consists of bathtub made of material of high-isolating properties, source of supply and a voltmeter. Metal electrodes are inserted into the bathtub filled with water (approx. coat is 5mm). Electrolysis effect should be

avoided because of gas bubbles, that completely change the potential. That's why the lab should be carried with alternative voltage. For signing disposition and shapes of equipotential lines pantograph is used.



To start signing equipotential lines on a sheet of paper, it's necessary to get outlines of electrodes' horizontal crosses. In order to do this you should lead round electrodes' outlines if source is *turned off*. For you to get depiction of equipotential lines you should define the points, moving probe. Repeating this action for different values of potential you'll get a family of equipotential lines. Using them it's possible to sign strength lines of the field.

№ *ви-міру*	Δx_i, *мм*	$\Delta \varphi_i$, *В*	Координата середини інтервалу x_i, *мм*	E, *В / м*
1				
...				
10				