

Electromagnetic Field Theory (BAB17EMP)

Homework 1

October 6, 2024

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Part A: Electrostatics: Analytic Calculations

Problem A-1 A pen-and-paper example (which may occur in the test). Calculate the electric field at varying distance along an axis that is perpendicular to and intersects a segment of length L in the middle. The segment has a uniform line charge density τ . (Hint: Employ Coulomb's Law and consider the substitution $u = z'/x$ to facilitate the integration. Additionally, utilizing any analytical mathematical software is permissible.)

(3 point)

Part B: Electrostatics: Numerical Implementation

In what follows, assume everywhere: $L = 1$ m, $\tau = 1$ C m⁻¹, and $N = 10$, charges are distributed along the y axis, and the plot is done for the x dependence of the electric field.

Plot everything in one figure. Use MATLAB/Python/...

Problem B-1 Suppose N uniformly distributed point charges q on a straight line of length L , where $Nq = \tau L$. Show the magnitude of the electric field along the perpendicular axis that intersects the middle of the section as a function of distance.

(2 point)

Problem B-2 Show magnitude of the electric field of a single charge $Q = \tau L$ placed at the middle of the line as a function of distance.

(1 points)

Problem B-3 Show magnitude of the electric field along the x axis of the section given by the expression gained in the first part of this homework, see Problem A-1.

(1 points)

Problem B-4 Show magnitude of the electric field along an infinite line with charge density τ as a function of distance.

(1 points)

Instructions

The deadline for all assignments is

- October 16th, 23:59.

All the problems are to be solved by students individually.

Contact us at em@fel.cvut.cz with any questions or comments. The team of teachers wishes you good luck in solving the problems.