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Exercise 1 (10 points)

a) Define gain and directivity and comment their importance.

b) Define the radar cross section of an electromagnetic scatterer (a target).

c) Obtain and explain the Friis transmission equation.

d) Obtain and explain the radar range equation for a monostatic radar.

e) Obtain and explain the radar range equation for a bistatic radar.

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Exercise 2 (12 points)

a) Define and explain the linear polarization of the electromagnetic field (time domain and phasor domain). Give an example of a source emitting a linearly polarized field.

b) Define and explain the circular polarization of the electromagnetic field (time domain and phasor domain). Give an example of a source emitting a right-hand circularly polarized field.

c) Give an example of elliptically polarized field in the time domain.

d) Starting from Maxwell's equations, prove that if the electric field is circularly polarized the magnetic field is circularly polarized, as well.

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Exercise 3 (12 points)

Let us consider a linear uniform array composed of 5 isotropic antennas working at the frequency of 150 MHz; the separation between two adjacent antennas is 1 m and the phase delay between two adjacent antennas is 0.

a) Calculate the directions of the main lobes.

b) Calculate the null directions.

c) Plot the radiation pattern.