

The RADAR Equation Course Project Proposal

Background: RADAR sends out a signal at a given wavelength and power and receives a return signal at a different power. This is given by the equation

$$P_R = \frac{P_T G^2 \lambda}{(4\pi)^3 R^4} \sigma \quad (1)$$

where P_R is the power received, P_T is the power transmitted, G is the antenna gain, λ is the wavelength, and σ is the RADAR cross-section. R is the distance from the RADAR antenna to an object that reflects the signal. (See the supplementary document.)

Project: Develop a numerical software package that, when given 5 known values, will return the sixth unknown value from Equation (1). You may always assume that P_R and P_T will be known. Usually, the unknown value is R ; you wish to acquire the distance to some unknown object. However, for testing purposes, it is beneficial to be able to determine the appropriate values of each parameter when the others are known. You do not need to have a single function for all cases (although this will score a nontrivial bonus). This software must allow the user the option of at least three different numerical techniques. In addition, there should be one function that has at least quadratic convergence.

Paper: Write a paper detailing the mathematics behind your software including any mathematical preprocessing included in your algorithms. The paper should also include necessary background to state the problem, a concise statement of the problem being addressed, a description of the software package including an error analysis, tests on known data, and a performance comparison of the various functions in the package. A brief users guide (i.e. instructions on how to run your software) should be included as an appendix.

Presentation: At the end of the semester, your group will give a 7-10 minute presentation on this project.

Peer Evaluations: Peer evaluations will be emailed to me by the individuals. Each student will numerically rank the participation of the group members and provide a written account of who did what during the project. Each group member must write at least one routine in the project to receive any credit for the project.