

AbstractID: 2673 Title: Use of Modified Fourier Series for Radiotherapy Optimization

Purpose: To introduce the use of modified Fourier series as a tool in the optimization of intensity profiles to be used in the calculation of absorbed dose in IMRT and to determine the number of terms in the series necessary to achieve a proper optimization.

Method and Materials: An analytic kernel is used in conjunction with a modified Fourier series approximation to the unknown intensity profile that optimizes the dose prescribed to a certain region in a mathematical phantom. A computer program was written to perform the optimization process. The advantage of using a Fourier series is that by adjusting a few constants, the exact number depending on the number of terms in the series, the whole intensity profile is modified, instead of having to discretize such a profile and change each of the intensity levels as one searches for the optimum profile. The effect of the number of terms in the Fourier series on the quality of the optimization is also explored.

Results: For the test case presented, it was determined that the number of terms in the series necessary to achieve a satisfactory solution, determined by a cost function, is 20. One problem, however, is that some of the resultant profiles show steep gradients over short distances, which poses a problem for the delivery process.

Conclusion: A useful method of calculating intensity profiles for IMRT has been introduced. Further work is needed to compare the quality of the optimization achieved using this technique to that with more established methods. The technique offers a way to introduce changes in the intensity profile that allows for a rapid dose calculation, since the total intensity is a sum of sine and cosine terms for which the dose can be pre-computed prior to the optimization process.