AbstractID: 8150 Title: Leaf sweep algorithm as an optimal control problem

This report presents the analytic expression for the optimal solution of the leaf-sequencing algorithm for continuous MLC IMRT dose delivery. The algorithm presented is valid for IMRT delivery for both stationary as well as for moving target. The solution for stationary target presented here is equivalent to dynamic programming approach and satisfies the condition of unidirectional motion of leafs. The optimality of the solution represents the minimization of the number of monitor units required for the delivery of a given intensity map (equivalently, the minimization of the time of dose delivery for the case when constant intensity rate is sustained for the irradiating device). Mathematically the problem under consideration is a problem in the control theory (calculus of variations) with variable ends and is formulated in the space of functions that describe the time of transfer of the left and the right jaw through a given position of the field. The condition bounding the maximum speed of the jaw motion is in the space of functions described above translated into the condition of minimal bound for the control function. This restriction and the additivity of the minimization of the time of delivery criterion play central role in the minimization of the criterion as they allows to notice that minimal admissible values of the control in each point on the field axis lead to minimum of the set criterion.