

In inverse treatment planning, the goal of producing the best possible dose distribution has to be reformulated as an optimization problem where stated clinical objectives are used by the planning system to generate a solution that does not violate the limitation of therapy delivery equipment. A commonly used approach was to design the optimization of intensity modulated beams to satisfy a prescribed dose distribution. In reality, however, tumor control and organ tolerance are more accurately assessed by the volumetric information of dose distributions, instead of the dose distribution themselves. Computationally, the optimization of a volumetric objective function is much more complex than that of a purely dose-based because of the indefinite relation between the dose and voxel indices. In this work, a dose volume histogram (DVH) based objective function is constructed for intensity-modulated radiation therapy optimization and an effective iterative algorithm is developed to optimize the system. Attempts were made to escalate the dose to the target while keeping specified fractions of the volumes of the sensitive structures below certain dose limits. During an iteration, the beamlets are addressed sequentially; each beamlet is chosen once and a small variation is given to its weight to decide its movement direction. The iteration process driven by the objective function continues until the best possible DVHs are achieved. The algorithm is applied to a few clinical cases and the results showed significant improvement in comparison with that of dose-based function, especially in the region near the target margin.