

As one of the delivery techniques in intensity-modulated radiotherapy (IMRT), the static mode (also called step and shoot technique) has been widely used because of the simple delivery and easy quality assurance. The optimization involved in the conventional static IMRT is a two-step process: first to calculate the modulated beam intensity maps using a time-consuming inverse planning algorithm, and then to translate these intensity maps into a series of uniform segments (apertures) using a leaf sequencing tool. In order to simplify the procedure and shorten the treatment time of the static mode, an efficient technique, called aperture based optimization (ABO), is developed in our work, which combines these two steps into a single one. Taken the pre-defined beams and the total aperture number per treatment as input, the aperture number for each beam, the aperture shapes and weights are selected and optimized automatically. A group of interim modulated intensity maps fast calculated using a conjugate gradient (CG) method are used to determine the aperture number for each beam and to initialize the aperture shapes. A modified genetic algorithm (GA) based on a two-dimensional binary coding scheme is used to optimize the aperture shapes, and CG is used to optimize the aperture weights. The physical characters of multileaf collimator (MLC) are incorporated into the optimization. The algorithm is applied to some examples and the results demonstrate that ABO is able to produce highly conformal dose distribution using 30~35 deliverable apertures per treatment within a clinically acceptable computation time.