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FINITELY CONVERGENT SEQUENTIAL ALGORITHMS AND THEIR APPLICATIONS TO INTENSITY-MODULATED RADIATION THERAPY

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Finding a point that satisfies a set of constraints is a common task in scientific computing, examples are the linear feasibility problem and the convex feasibility problem. One of the many application areas is Intensity-Modulated Radiation Therapy (IMRT) planning. Finitely convergent sequential algorithms can be used for solving such problems; an example of such an algorithm is ART3 [1], which is defined in such a way that its control is cyclic in the sense that during its execution it repeatedly cycles through the given constraints. We found a variant of ART3 whose control is no longer cyclic, but which is still finitely convergent and in practice it usually converges faster than ART3 does [2]. We discuss a general methodology for automatic transformation of finitely convergent sequential algorithms, in such a way that (i) finite convergence is retained and (ii) the speed of convergence is improved. The first of these two properties is proven by mathematical theorems, the second is illustrated by applying the algorithms in IMRT planning.

References

[1] G. T. Herman, A relaxation method for reconstructing objects from noisy x-rays, *Mathematical Programming,* **8** (1975) 1–19.

[2] G. T. Herman and W. Chen, A fast algorithm for solving a linear feasibility problem with application to intensity-modulated radiation therapy, *Linear Algebra and Its Applications*, **428** (2008) 1207–1217.