

# Optimization in Surgical Operation Design\*

Tibor Csendes<sup>a</sup>, István Bársony<sup>b</sup>, and István Szalay<sup>c</sup>

<sup>a</sup>University of Szeged, Institute of Informatics  
csendes@inf.u-szeged.hu

<sup>b</sup>Kecskemét College, Institute of Natural Sciences and Engineering  
barsony.istvan@gamf.kefo.hu

<sup>c</sup>University of Szeged, Faculty of Medicine, Department of Urology

## Abstract

Brachytherapy is a modern treatment with less side effects for some kind of cancer diseases. Radioactive material (seeds) is placed permanently or temporarily near to or within the tumor. Although the treatment has a well based and accepted protocol, there remained still interesting questions to be answered by nonlinear optimization. We have investigated possible solution methods for the high dimension (90-240) constrained nonlinear optimization problem. Our aim was to reduce the computation time to shorten the anesthetized time for the patient, to improve the approximative solutions enabling less side effects, and to allow the usage of different intensity radioactive seeds (decreasing the cost of the treatment).

*Keywords:* brachytherapy, seeds, optimal positioning

*MSC:* 65G30, 90C30

## References

- [1] T. CSENDES, L. PÁL, J.O.H. SENDÍN, AND J.R. BANGA, The GLOBAL Optimization Method Revisited, *Optimization Letters* Vol. 2 (2008), 445–454.
- [2] M.Cs. MARKÓT AND T. CSENDES, A new verified optimization technique for the "packing circles in a unit square" problems, *SIAM J. on Optimization*, Vol. 16 (2005), 193–219.
- [3] P.G. SZABÓ, M.Cs. MARKÓT, T. CSENDES, E. SPECHT, L.G. CASADO, AND I. GARCÍA, New Approaches to Circle Packing in a Square – With Program Codes, *Springer*, Berlin, 2007

---

\*The research was supported by the European Union and the European Social Fund through the project National Excellence in the Convergence Region (grant TAMOP-4.2.4-A/2) in the frame of a János Szentágothai Fellowship.