12th Joint Conference on Mathematics and Computer Science, June 14 – 17, 2018, Cluj, Romania1

## Optimization in periodic spline interpolation Gábor Fábián

Department of Numerical Analysis, Eötvös Loránd University fabian@numanal.inf.elte.hu

The periodic spline interpolation problem has unique solution, therefore besides the common boundary conditions, there is no parameter that can be used in any types of optimization. Since many geometric applications require only the continuity of the first derivative, we try to introduce a parameter by leaving the condition about the continuity of second derivative at the endpoints of the period of the function. In this paper we give exact recursive formulas to calculate cubic spline interpolants with continuous first derivatives in all points of their domains and continuous second derivatives in all points except the boundary of their periods. In this case, we have one free parameter to choose that is used to find a solution with some optimal properties. The objective function of the optimization can be freely chosen, the parameter to be optimized is the second derivative at the starting point of the period. We give two possible applications of our result. First we solve a common one-dimensional interpolation problem where the maximum norm of the spline will be minimized. Thereafter we are looking for the minimum arc length differentiable plane curve that interpolates at points of an arbitrary given point set.

## References

- B. A. Dubrovin, A. T. Fomenko, S. P. Novikov. Modern Geometry Methods and Applications. Springer, 1992.
- [2] J. Nocedal, S. J. Wright. Numerical Optimization (Second Edition). Springer, 2006.
- [3] W. H. Press et al. Numerical recipes in C The Art of Scientific Computing (Second Edition). Cambridge University Press, 1992.
- [4] J. Stoer, R. Bulirsch. Introduction to Numerical Analysis (Second Edition). Springer-Verlag, 1993.