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MSC: 65D05, 65D07

## SHAPE PRESERVATION CONDITIONS UNDER INTERPOLATION BY SUBBOTIN'S PARABOLIC SPLINES<sup>1</sup>

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Parabolic splines are applied to solve an interpolation problem with the conditions of preserving the piecewise monotonicity and convexity. Sufficient conditions are established for the piecewise monotonicity and convexity of Subbotin's quadratic interpolation splines, and numerical examples are given.

Keywords: quadratic spline, interpolation, shape preservation.

### REFERENCES

1. Miroshnichenko V. L. Convex and monotone spline interpolation. *Constructive Theory of Function, Proc. Int. Conf., Varna, 1984*, Sofia: Publ. House of Bulgarian Acad. Sci., 1984, pp. 610–620.
2. Miroshnichenko V. L. Sufficient conditions for monotonicity and convexity of parabolic spline interpolants. *Siberian Adv. Math.*, 1993, vol. 3, no. 4, pp. 101–107.
3. Volkov Yu. S., Bogdanov V. V., Miroshnichenko V. L., Shevaldin V. T. Shape-preserving interpolation by cubic splines. *Math. Notes.*, 2010, vol. 88, no. 6, pp. 798–805.
4. Volkov Yu. S., Shevaldin V. T. Shape preserving conditions for quadratic spline interpolation in the sense of Subbotin and Marsden. *Tr. Inst. Mat. Mekh. UrO RAN.*, 2012, vol. 18, no. 4, pp. 145–152 (in Russian).
5. Zav'yalov Yu. S. On a nonnegative solution of a system of equations with a nonstrictly jacobian matrix. *Sib. Math. J.*, 1996, vol. 37, no. 6, pp. 1143–1147.
6. Bogdanov V. V. Sufficient conditions for the comonotone interpolation of cubic  $C^2$  splines. *Sib. Adv. Math.*, 2012, vol. 22, no. 3, pp. 153–160.
7. Volkov Yu. S. A new method for constructing cubic interpolating splines. *Dokl. Math.*, 2002, vol. 65, no. 1, pp. 13–15.
8. Volkov Yu. S. A new method for constructing cubic interpolating splines. *Comput. Math. Math. Phys.*, 2004, vol. 44, no. 2, pp. 215–224.
9. Bogdanov V. V. Sufficient conditions for the nonnegativity of solutions to a system of equations with a nonstrictly jacobian matrix. *Sib. Math. J.*, 2013, vol. 54, no. 3, pp. 425–430.
10. Stechkin S. B., Subbotin Yu. N. *Splajny v vychislitelnoj matematike* (Splines in numerical mathematics). Moscow: Nauka Publ., 1976, 248 p. (in Russian).
11. Volkov Y. S. On monotone interpolation by cubic splines. *Vychisl. Tekhn.*, 2001, vol. 6, no. 6, pp. 14–24 (in Russian).
12. Bogdanov V. V., Volkov Yu. S. Selection of parameters of generalized cubic splines with convexity preserving interpolation. *Sib. Zh. Vychisl. Mat.*, 2006, vol. 9, no. 1, pp. 5–22 (in Russian).
13. Collatz L. *Funktionalanalysis und Numerische Mathematik*. Berlin: Springer-Verlag, 1964, 371 p.
14. Zav'yalov Y. S., Kvasov, B. I., Miroshnichenko, V. L. *Metody splajn-funkcij* (Methods of spline functions). Moscow: Nauka Publ., 1980, 352 p. (in Russian).

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15. Marsden M. Quadratic spline interpolation. *Bull. Amer. Math. Soc.*, 1974, vol. 80, no. 5, pp. 903–906.
16. Volkov Yu. S. Interpolation by splines of even degree according to Subbotin and Marsden. *Ukr. Math. J.*, 2014, vol. 66, no. 7, pp. 994–1012.

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