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COMPARISON OF THE REMAINDERS OF THE SIMPSON QUADRATURE FORMULA AND THE QUADRATURE FORMULA FOR THREE-POINT RATIONAL INTERPOLANTS

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A quadrature formula with positive coefficients is constructed with the use of three nodes a, b, and $c = (a+b)/2$ and rational interpolants of the form $\rho(x) = \alpha + \beta(x-c) + \gamma/(x-g)$ with a pole g determined by nodes outside the integration interval $[a, b]$. The error of the constructed formula is smaller than the error of the corresponding Simpson quadrature formula if the integrand $f(x)$ has a continuous derivative $f^{(4)}(x)$ on the interval $[a, b]$ and the inequality $f^{(4)}(x)f''(x) > 0$ is satisfied.

Keywords: rational interpolant, quadrature formula, Simpson formula.

REFERENCES

1. Ahlberg J., Nilson E., Walsh J. *The theory of splines and their applications*. TH: Acad. Press, 1967, 284 p. ISBN: 9781483222950 . Translated to Russian under the title *Teoriya splainov i ee prilozheniya*, Moscow: Mir Publ., 1972, 316 p.
2. Stechkin S.B., Subbotin Yu.N. *Splainy v vychislitel'noi matematike* [Splines in computational mathematics]. Moscow: Nauka Publ., 1976, 248 p.
3. Zav'yalov Yu.S., Kvasov B.I., Miroshnichenko V.L. *Metody splain-funktsii* [Methods of spline-functions]. Moscow: Nauka Publ., 1980, 352 p.
4. Berdyshev V.I., Subbotin Yu.N. *Chislennye metody priblizheniya funktsii* [Numerical methods for approximation of functions]. Sverdlovsk: Sredne-Ural'skoe Kn. Izd-vo, 1979, 120 p.
5. Arushanyan I.O. *Primenenie metoda kvadratur dlya chislennogo resheniya integral'nykh uravnenii vtorogo roda* [Application of the quadrature method for numerical solutions of integral equations of the second order]. Moscow: Izd-vo TsPI Mekh.-Mat. MGU, 2018, 61 p.
6. Edeo A., Gofeb G., Tefera T. Shape preserving C^2 rational cubic spline interpolation. *American Scientific Research Journal for Engineering, Technology and Sciences*, 2015, vol. 12, no. 1. pp. 110–122.
7. Magomedova V.G., Ramazanov A.-R.K. Approximate solution of differential equations with the help of rational spline functions. *Comput. Math. and Math. Phys.*, 2019, vol. 59, no. 4, pp. 542–549. doi: 10.1134/S0965542519040110 .
8. Nikolskiy S.M. *Kvadraturnie formuli* [Quadrature formulae]. Moscow: Nauka Publ., 1988, 255 p. ISBN: 5-02-013786-3 .
9. Bakhvalov N.S., Zhidkov N.P., Kobel'kov G.M. *Chislennye metody* [Numerical methods]. Moscow: Laboratoriya Bazovykh Znanii Publ., 2002, 632 p. ISBN: 5-93208-043-4 .
10. Krylov V.I., Bobkov V.V., Monastyrnyi P.I. *Vychislitel'nye metody* [Computational methods]. Vol. 1. Moscow: Nauka Publ., 1976, 304 p.
11. Ramazanov A.-R.K., Magomedova V.G. Splines for three-point rational interpolants with autonomous poles. *Dagestan. Elektron. Mat. Izv.*, 2017, no. 7, pp. 16–28 (in Russian). doi: 10.31029/demr.7.2 .
12. Householder A.S. *Principles of numerical analysis*. NY; Toronto; London: McGRAW-HILL, 1953, 274 p. Translated to Russian under the title *Osnovy chislennogo analiza*, Moscow: Izd-vo Inostr. Lit-ry, 1956, 320 p.

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