On functionally-fitted Runge-Kutta methods

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Abstract: Functionally-fitted methods are generalizations of collocation techniques to integrate an equation exactly if its solution is a linear combination of a chosen set of basis functions. When these basis functions are chosen as the power functions, we recover classical algebraic collocation methods. This paper shows that functionally-fitted methods can be derived with less restrictive conditions than previously stated in the literature, and that other related results can be derived in a much more elegant way. The novelty in our approach is to fully retain the collocation framework without reverting back into derivations based on cumbersome Taylor series expansions.
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References:

- Burrage, K., (1995) Parallel and Sequential Methods for Ordinary Differential Equations, , Oxford University Press, Oxford
- Coleman, J.P., Duxbury, S.C., Mixed collocation methods for y″ = f(t, y) (2000) J. Comput. Appl. Math., 126, pp. 47-75
- Franco, J.M., An embedded pair of exponentially fitted explicit Runge-Kutta methods (2002) J. Comput. Appl. Math., 149, pp.

407-414

- Franco, J.M., Exponentially fitted explicit Runge-Kutta-Nyström methods (2004) J. Comput. Appl. Math., 167, pp. 1-19
- Hairer, E., Wanner, G., (1991) Solving Ordinary Differential Equations II, Stiff and Differential-algebraic Problems, , Springer, Berlin
- Hoang, N.S., Sidje, R.B., Cong, N.H., Analysis of trigonometric implicit Runge-Kutta methods (2006) J. Comput. Appl. Math., , to appear
- Ozawa, K., A four-stage implicit Runge-Kutta-Nyström method with variable coefficients for solving periodic initial value problems (1999) Japan J. Indust. Appl. Math., 16, pp. 25-46
- Ozawa, K., Functional fitting Runge-Kutta method with variable coefficients (2001) Japan J. Indust. Appl. Math., 18, pp. 105-128
- Ozawa, K., Functional fitting Runge-Kutta-Nyström method with variable coefficients (2002) Japan J. Indust. Appl. Math., 19, pp. 55-85
- Ozawa, K., A functionally fitted three-stage explicit singly diagonally implicit Runge-Kutta method (2005) Japan J. Indust. Appl. Math., 22, pp. 403-427
- Paternoster, B., Runge-Kutta(-Nyström) methods for ODEs with periodic solutions based on trigonometric polynomials (1998) Appl. Numer. Math., 28, pp. 401-412
- Van Der Houwen, P.J., Sommeijer, B.P., Cong, N.H., Stability of collocation-based Runge-Kutta-Nyström methods (1991) BIT, 31, pp. 469-481
- Vanden Berghe, G., Ixaru, L.G., De Meyer, H., Frequency determination and steplength control for exponentially-fitted Runge-Kutta methods (2001) J. Comput. Appl. Math., 132, pp. 95-105
- Vanden Berghe, G., Ixaru, L.G., Van Daele, M., Optimal implicit exponentially-fitted Runge-Kutta methods (2001) Comput. Phys. Comm., 140, pp. 346-357
- Wright, K., Some relationships between implicit Runge-Kutta, collocation and Lanczos τ methods, and their stability properties (1970) BIT, 10, pp. 217-227