

SECOND HANKEL DETERMINANT FOR A SUBCLASS OF ANALYTIC FUNCTIONS INVOLVING Q -ANALOGUE OF RUSCHEWEYH OPERATOR
(Penentu Hankel Kedua untuk Subkelas Fungsi Analisis Melibatkan Pengoperasi Ruscheweyh Analog- q)

SUHILA ELHADDAD & MASLINA DARUS*

ABSTRACT

Let S be the class of analytic functions which are univalent and normalised in the open unit disc $U = \{z \in \mathbb{C} : |z| < 1\}$. Second Hankel determinant of $|a_2a_4 - a_3^2|$ for a class of analytic functions involving q -analogue of Ruscheweyh operator is given.

Keywords: q -analogue of Ruscheweyh Operator; Fekete-Szego functional; Hankel determinant

ABSTRAK

Andaikan S sebagai kelas fungsi analisis yang univalen dan ternormal dalam cakera unit terbuka $U = \{z \in \mathbb{C} : |z| < 1\}$. Diberi penentu Hankel kedua $|a_2a_4 - a_3^2|$ untuk kelas fungsi analisis yang melibatkan analog- q bagi pengoperasi Ruscheweyh.

Kata kunci: Pengoperasi Ruscheweyh analog- q ; fungsian Fekete-Szego; penentu Hankel

References

- Abubaker A. & Darus M. 2011. Hankel determinant for a class of analytic functions involving a generalized linear differential operator. *International Journal of Pure and Applied Mathematics* **69**(4): 429-435.
- Aldweby H. & Darus M. 2014. Some subordination results on q -analogue of Ruscheweyh differential operator. *Abstract and Applied Analysis* **2014**: 1-6.
- Aldweby H. & Darus M. 2013. A subclass of harmonic univalent functions associated with q -analogue of Dziok-Srivastava operator. *ISRN Math. Anal.* **2013**: 1-6.
- Aral A., Gupta V. & Agarwal R.P. 2013. *Applications of Q -Calculus in Operator Theory*. New York: Springer.
- Bansal D. 2013. Upper bound of second hankel determinant for a new class of analytic functions. *Applied Mathematics Letters* **26**(1): 103-107.
- Duren P.L. 1983. *Univalent Functions. Grundlehren der Mathematischen Wissenschaften*. New York: Springer.
- Elhaddad S., Aldweby H. & Darus M. 2018. Some properties on a class of harmonicunivalent functions defined by q -analogue of Ruscheweyh operator. *Journal of Mathematical Analysis* **9**(2): 28-35.
- Elhaddad S. & Darus M. 2019. On meromorphic functions defined by a new operator containing the Mittag-Leffler function. *Symmetry* **11**(2): 210.
- Exton H. 1983. *q -Hypergeometric Functions and Applications*. Chichester: Ellis Horwood.
- Jackson F.H. 1908. On q -functions and a certain difference operator. *Transactions of the Royal Society of Edinburgh* **46**: 253-281.
- Jackson F.H. 1910. On q -definite integrals. *The Quarterly Journal of Pure and Applied Mathematics* **41**: 193-203.
- Janteng A., Halim S.A. & Darus M. 2006. Coefficient inequality for a function whose derivative has a positive real part. *Journal of Inequalities in Pure and Applied Mathematics* **7**(2): 1-5.
- Janteng A., Halim S.A. & Darus M. 2007. Hankel determinant for starlike and convex functions. *International Journal of Mathematical Analysis* **1**(13): 619-625.
- Libera R.J. & Zlotkiewicz E.J. 1982. Early coefficients of the inverse of a regular convex function. *Proceedings of the American Mathematical Society* **85**(2): 225-230.
- Libera R.J. & Zlotkiewicz E.J. 1983. Coefficient bounds for the inverse of a function with derivative in P. *Proceedings of the American Mathematical Society* **87**(2): 251-257.

- Macgregor T.H. 1962. Functions whose derivative has a positive real part. *Transactions of the American Mathematical Society* **104**(3): 532–537.
- Mahmood S., Srivastava H.M., Khan N., Ahmad Q.Z., Khan B. & Ali I. 2019. Upper bound of the third Hankel determinant for a subclass of q -starlike functions. *Symmetry* **11**(3): 347.
- Mogra M.L. 1999. Applications of Ruscheweyh derivatives and Hadamard product to analytic functions. *International Journal of Mathematics and Mathematical Sciences* **22**(4): 795-805.
- Mohammed A. & Darus M. 2012. Second Hankel determinant for a class of analytic functions defined by a linear operator. *Tamkang Journal of Mathematics* **43**(3): 455–462.
- Mohammed A. & Darus M. 2013. A generalized operator involving the q -hypergeometric function. *Mat. Vesnik* **65**: 454-465.
- Noonan J. & Thomas D. 1976. On the second Hankel determinant of areally mean p -valent functions. *Transactions of the American Mathematical Society* **223**: 337–346.
- Pommerenke C. 1966. On the coefficients and Hankel determinants of univalent functions. *Journal of the London Mathematical Society* **1**(1): 111–122.
- Pommerenke C. 1967. On the Hankel determinants of univalent functions. *Mathematika* **14**(1): 108–112.
- Purohit S.D. & Raina R.K. 2011. Certain subclasses of analytic functions associated with fractional q -calculus operators. *Mathematica Scandinavica* **109**: 55–70.
- Purohit S.D. & Raina R.K. 2013. Fractional q -calculus and certain subclass of univalent analytic functions. *Mathematica (Cluj)* **55**(78): 62-74.
- Raducanua D. & Zaprawab P. 2017. Second Hankel determinant for close-to-convex functions. *Comptes Rendus Mathematique* **355**(10): 1063-1071.
- Ruscheweyh S. 1975. New criteria for univalent functions. *Proceedings of the American Mathematical Society* **49**: 109-115.
- Shukla S.L. & Kumar V. 1983. Univalent functions defined by Ruscheweyh derivatives. *International Journal of Mathematics and Mathematical Sciences* **6**(3): 483-486.
- Srivastava H.M. 1989. Univalent functions, fractional calculus, and associated generalized hypergeometric functions, in *Univalent Functions; Fractional Calculus; and Their Applications* (H. M. Srivastava and S. Owa, Editors), Halsted Press (Ellis Horwood Limited, Chichester), pp. 329-354, John Wiley and Sons, New York, Chichester, Brisbane and Toronto.
- Srivastava H.M., Altinkaya S. & Yalcin S. 2018. Hankel determinant for a subclass of bi-univalent functions defined by using a symmetric q -derivative operator. *Filomat* **32**(2): 503–516.

Department of Mathematical Sciences
Faculty of Science and Technology
Universiti Kebangsaan Malaysia
43600 UKM Bangi
Selangor DE, MALAYSIA
*E-mail: suhila.e@yahoo.com, maslina@ukm.edu.my**

Received: 9 March 2020

Accepted: 21 March 2020

*Corresponding author