ANOTHER LOOK AT VORONOVSKAJA TYPE FORMULAS

FADEL NASAIREH AND IOAN RAŞA

Abstract. Voronovskaja type formulas are usually established for sequences of positive linear operators, i.e, operators P_n with $P_n f \geqslant 0$ whenever the function f is positive. The aim of this paper is twofold. First, we obtain some general formulas concerning compositions of operators on Banach spaces, without any assumption of positivity. Next, we establish Voronovskaja type formulas for operators which are manifestly nonpositive. Combining these two approaches we recover some known results and obtain new applications. The final section is devoted to inequalities accompanying our formulas.

Mathematics subject classification (2010): 41A36, 41A35, 26D20, 41A30.

Keywords and phrases: Positive operators, nonpositive operators, Voronovskaja type formulas, inequalities.

REFERENCES

[1] U. ABEL, M. IVAN, *Asymptotic expansion of the multivariate Bernstein polynomials on a simplex*, Approx. Theory Appl. **16** (2000), 85–93.

[2] SH. COOPER, SH. WALDRON, *The eigenstructure of the Bernstein operator*, J. Approx. Theory **105** (2000), 133–165.

[3] H. GONSKA, M. HEILMANN, A. LUPAŞ, I. RAŞA, *On the composition and decomposition of positive linear operators III: A non-trivial decomposition of the Bernstein operator*, http://arxiv.org/abs/1204.2723, August 30, 2012.

[4] H. GONSKA, M. HEILMANN, I. RAŞA, *Eigenstructure of the genuine Beta operators of Lupaş and Mühlbach*, Studia Univ. Babeş-Bolyai Math. **61** (2016), 383–388.

[5] H. GONSKA, D. KACSÓ, I. RAŞA, *On genuine Bernstein-Durrmeyer operators*, Results Math. **50** (2007), 213–225.

[6] H. GONSKA, D. KACSÓ, I. RAŞA, *The genuine Bernstein-Durrmeyer revisited*, Results Math. **62** (2012), 295–310.

[7] H. GONSKA, P. PIŢUL, I. RAŞA, *On differences of positive linear operators*, Carpathian J. Math. **22** (2006), 65–78.

[8] H. GONSKA, I. RAŞA, *On the composition and decomposition of positive linear operators (V)*, Results Math. DOI 10.1007/s00025-06-0618-8.

[9] H. GONSKA, I. RAŞA, E.-D. STĂNILĂ, *Beta operators with Jacobi weights, In: Constructive theory of functions*, Sozopol 2013 (K. Ivanov, G. Nikolov and R. Uluchev, Eds.), 99–112. Prof. Marin Drinov Academic Publishing House, Sofia, 2014.

[10] M. HEILMANN, F. NASAIREH, I. RAŞA, *Beta and related operators revisited*, Preprint 2016.

[11] M. HEILMANN, I. RAŞA, *On the decomposition of Bernstein operators*, Numer. Funct. Anal. Optimiz., **36** (2015), 72–85.

[12] A. LUPAŞ, *Die Folge der Betaoperatoren*, Dissertation, Universität Stuttgart (1972).

[13] G. MÜHLBACH, *Rekursionsformeln für die zentralen Momente der Pólya- und der Beta-Verteilung*, Metrika **19** (1972), 171–177.

[14] G. MÜHLBACH, *Verallgemeinerungen der Bernstein- und der Lagrangepolynome. Bemerkungen zu einer Klasse linearer Polynomoperatoren von D. D. Stancu*, Rev. Roumaine Math. Pures Appl. **15** (1970), 1235–1252.

Journal of Mathematical Inequalities
www.ele-math.com
jmi@ele-math.com