

## Differences of positive linear operators and the second order modulus

HEINER GONSKA and IOAN RAȘA

### ABSTRACT.

Differences of (sequences of) positive linear operators and their limiting behavior are considered in this note. Special emphasis is on the use of second order moduli of smoothness. We thus are able to give, among other things, improved Voronovskaya-type inequalities. All considerations are based on another look at the remainder in Taylor's formula.

### REFERENCES

- [1] Gonska, H., *Quantitative Korovkin-type theorems on simultaneous approximation*, Math. Z., **186** (1984), 419–433
- [2] Gonska, H., *On the degree of approximation in Voronovskaja's theorem*, Studia Univ. Babeș-Bolyai, Mathematica **52** (2007), 103–116
- [3] Gonska, H., Kovacheva, R., *The second order modulus revisited: remarks, applications, problems*, Confer. Sem. Mat. Univ. Bari 257 (1994), 1–32
- [4] Gonska, H., Kacsó, D., Rașa, I., *On genuine Bernstein-Durrmeyer operators*, Results in Mathematics **50** (2007), 213–225
- [5] Gonska, H., Meier, J., *On approximation by Bernstein-type operators: best constants*, Studia Sci. Math. Hungar. **22** (1987), 287–297
- [6] Gonska, H., Pițul, P., Rașa, I., *On Peano's form of the Taylor remainder, Voronovskaja's theorem and the commutator of positive linear operators*, in *Numerical Analysis and Approximation Theory* (Proc. Int. Conf. Cluj-Napoca 2006; ed. by O. Agratini and P. Blaga, Casa Cărții de Știință), 55–80
- [7] Gonska, H., Pițul, P., Rașa, I., *On differences of positive linear operators*, Carpathian J. Math., **22** (2006), No. 1-2, 65–78
- [8] Gonska, H., Rașa, I., *On the composition and decomposition of positive linear operators (II)* (submitted for publication)
- [9] Kacsó, D., *Certain Bernstein-Durrmeyer-type Operators Preserving Linear Functions*, Habilitationsschrift, Universität Duisburg–Essen 2006. Schriftenreihe des Fachbereichs Mathematik **SM-DU-675** (2008)
- [10] Lupaș, A., *The approximation by means of some linear positive operators*, in *Approximation Theory* (Witten, 1995), Berlin, Akademie-Verlag 201–229
- [11] Mitjagin, B. S., Semenov, E. M., *Absence of interpolation of linear operators in spaces of smooth functions (Russian)*, Izv. Akad. Nauk SSSR Ser. Mat. **41** (1977), No. 6, 1289–1328

UNIVERSITY DUISBURG-ESSEN  
DEPARTMENT OF MATHEMATICS  
FORSTHAUSWEG 2, D-47057, DUISBURG, GERMANY  
E-mail address: heiner.gonska@uni-due.de

TECHNICAL UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
STR. C. DAICOVICIU 15, RO-400020 CLUJ-NAPOCA, ROMANIA  
E-mail address: Ioan.Rasa@math.utcluj.ro

Received: 28.10.2008; In revised form: 07.04.2009; Accepted: 07.05.2009  
2000 *Mathematics Subject Classification*. 41A10, 41A15, 41A25, 41A36.

Key words and phrases. *Positive linear operators, moduli of continuity (smoothness), degree of approximation, Bernstein operator, genuine Bernstein-Durrmeyer operator, Stancu operator, Beta-type operator, Voronovskaya-type theorem, simultaneous approximation.*