

## ON THE APPROXIMATE CONTINUITY OF VECTOR FUNCTIONS

ZBIGNIEW GRANDE

Institute of Mathematics, Kazimierz Wielki University  
Plac Weyssenhoffa 11, 85-072 Bydgoszcz, Poland  
E-mail: grande@ukw.edu.pl

**Abstract.** We prove an equivalent condition to the approximate continuity with respect to some differentiation bases of vector functions. This condition is an counterpart of Lipiński condition from [12] for real functions  $f : \mathbb{R} \rightarrow \mathbb{R}$ .

**Key Words and Phrases:** Differentiation basis, approximate continuity, Bochner integrability, derivatives, fixed point.

**2010 Mathematics Subject Classification:** 28A15, 28B05, 54H25, 26B05, 46G10.

### REFERENCES

- [1] A.M. Bruckner, *Differentiation of real functions*, Lecture Notes in Math. 659, Springer-Verlag, Berlin, 1978.
- [2] A.M. Bruckner, *Differentiation of integrals*, American Math. Monthly, **78**(9)(1971), 1–51.
- [3] M. Csornyei, T.C. O’Neil, D. Preiss, *The composition of two derivatives has a fixed point*, Real Anal. Exchange, **26**(2000–2001), 749–760.
- [4] M. Elekes, T. Keleti, V. Prokaj, *The composition of derivatives has a fixed point*, Real Anal. Exchange, **27**(1)(2001–2002), 131–140.
- [5] F.B. Fuller, *Fixed points of multiple-valued transformations*, Proc. Amer. Math. Soc., (1961), 165–169.
- [6] R. Gibson, T. Natkaniec, *Darboux like functions. Old problems and new results*, Real Anal. Exchange, **24**(2)(1998-99), 487–496.
- [7] Z. Grande, *Sur les fonctions approximativement continues*, Colloquium Mathematicum, **29**(1974), 247–251.
- [8] O.H. Hamilton, *Fixed points for certain noncontinuous transformations*, Proc. Amer. Math. Soc., **8**(1957), 750–756.
- [9] P.D. Humke, R.E. Svetic, C.E. Weil, *A Darboux, Baire one fixed point problem*, Real Anal. Exchange, **26**(2000–2001), 893–900.
- [10] Kolodziej, *Analiza matematyczna*, PWN 1978 (in Polish).
- [11] C. Kuratowski, *Topologie I*, PWN 1958.
- [12] J.S. Lipiński, *Sur les fonctions approximativement continues*, Colloquium Mathematicum, **5**(1958), 172–175.
- [13] J. Nash, *Generalized Brouwer theorem*, Bull. Amer. Math. Soc. Research Problem, 62-1-76, (1956), page 76.
- [14] R.J. O’Malley, *Approximately differentiable functions. The topology*, Pacific J. Math., **72**(1977), 207–222.
- [15] D. Preiss, *Maximoff’s Theorem*, Real Anal. Exchange, **5**(1)(1979-80), 92–104.

[16] S. Saks, *Theory of the integral*, Monografie Matematyczne 3, New York, 1937.

*Received: September 17, 2013; Accepted: January 23, 2014.*