# ON SOLUTION METHOD FOR POSSIBILISTIC OPTIMIZATION PROBLEM OF ONE CLASS WITH PARAMETERS CHARACTERIZED BY QUASICONCAVE UPPER SEMICONTINUOUS STRICTLY UNIMODAL DISTRIBUTION FUNCTIONS

### Soldatenko Ilia Sergeyevich

Associate Professor at Information Technologies department, Tver State University Russia, 170100, Tver, 33 Zhelyabova str., TSU. E-mail: soldis@tversu.ru

#### Received 11.01.2016, revised 22.01.2016.

The problem of possibilistic level optimization with parameters characterized by quasiconcave upper semicontinuous strictly unimodal distribution functions is studied. The equivalent crisp analogue is constructed for the problem. We use the weakest and the strongest triangular norms in order to aggregate fuzzy information. Results obtained in the article generalize the case when parameters of the task are characterized by parameterized fuzzy numbers of (L,R)-type.

**Keywords:** possibilistic programming, level optimization, triangular norm, weakest t-norm  $T_W$ , indirect solution method, equivalent crisp analogue.

Nechetkie Sistemy i Myagkie Vychisleniya [Fuzzy Systems and Soft Computing], 2016, vol. 11, no. 1, pp. 19-32.

#### References

- Yazenin A.V. On the problem of possibilistic optimization. Fuzzy Sets and Systems, 1996, vol. 81, pp. 133–140.
- [2] Yazenin A.V., Wagenknecht M. Possibilistic optimization. Brandenburgische Technische Universitat, Cottbus, Germany, 1996.
- [3] Soldatenko I.S., Yazenin A.V. Possibilistic optimization problems with mutually t-related parameters: comparative study. *Journal of Computer and Systems Sciences International*, 2008, no. 5, pp. 87–98.
- [4] Yazenin A., Soldatenko I. Possibilistic optimization tasks with mutually T-related parameters: solution methods and comparative analysis. *Studies in Fuzziness and Soft Computing*, 2010, vol. 254, pp. 163–192. doi:10.1007/978-3-642-13935-2
- [5] Bellman R.E., Zadeh L.A. Decision making in a fuzzy environment. Management Science, 1970, vol. 17, pp. 141–162.
- [6] Luhandjula M.K. On possibilistic linear programming. Fuzzy Sets and Systems, 1986, vol. 18, pp. 15-30.

- [7] Luhandjula M.K. Fuzzy optimization: an appraisal. Fuzzy Sets and Systems, 1989, vol. 30, pp. 257–282.
- [8] Dyubua D., Prad A. *Teoriya Vozmozhnostei* [Theory of Possibilities]. "Radio i svyaz" Publ., Moscow, 1990. (in Russian)
- [9] Nguyen H.T., Walker E.A. A First Cours in Fuzzy Logic. CRC Press, 1997.
- [10] Nahmias S. Fuzzy variables. Fuzzy Sets and Systems, 1978, vol. 1, pp. 97-110.
- [11] Dubois D., Prade H. Fuzzy numbers: an overview. Analysis of Fuzzy Information. Ed. by J. Bezdek. Vol. 2. CRC-Press, Boca Raton, 1988. Pp. 3–39.
- [12] Dubois D., Prade H. Fuzzy Sets and Systems: Theory and Applications. Academic Press, New York, 1980.
- [13] Schweizer B., Sklar A. Probabilistic Metric Spaces. North Holland, New York, 1983.
- [14] Klement E.P., Mesiar R., Pap E. Triangular norms. Position paper I: basic analytical and algebraic properties. *Fuzzy Sets and Systems*, 2004, vol. 143(1), pp. 5–26.
- [15] Klement E.P., Mesiar R., Pap E. Triangular norms. Position paper II: general constructions and parameterized families. *Fuzzy Sets and Systems*, 2004, vol. 145(3), pp. 411–438.
- [16] Klement E.P., Mesiar R., Pap E. Triangular norms. Position paper III: continuous t-norms. Fuzzy Sets and Systems, 2004, vol. 145(3), pp. 439–454.
- [17] Mesiar R. A note to the T-sum of L-R fuzzy numbers. Fuzzy Sets and Systems, 1996, vol. 79, pp. 259–261.
- [18] Klement E.P., Mesiar R., Pap E. A characterization of the ordering of continous t-norms. Fuzzy Sets and Systems, 1997, vol. 86, pp. 189–195.
- [19] Marková-Stupňanová A. A note to the addition of fuzzy numbers based on a continuus Archimedean T-norm. Fuzzy Sets and Systems, 1997, vol. 91, pp. 253– 258.
- [20] Mesiar R. Computation of L-R-fuzzy numbers. Proc. of 5th International Workshop on Current Issues in Fuzzy Technologies. Trento, 1995. Pp. 165–176.
- [21] Mesiar R. Triangular-norm-based addition of fuzzy intervals. Fuzzy Sets and Systems, 1997, vol. 91, pp. 231–237.
- [22] Mesiar R. Shape preserving additions of fuzzy intervals. Fuzzy Sets and Systems, 1997, vol. 86, pp. 73–78.
- [23] Rao M.B., Rashed A. Some comments on fuzzy variables. Fuzzy Sets and Systems, 1996, vol. 6, pp. 285–292.
- [24] Soldatenko I.S. On a weighted sum of mutually Tw-related fuzzy values. Vestnik TvGU. Seriya: Prikladnaya Matematika [Herald of Tver State University. Series: Applied Mathematics], 2007, no. 4, pp. 63–77. (in Russian)

- [25] Yazenin A.V. Fuzzy and Stochastic Programming. Fuzzy Sets and Systems, 1987, vol. 22, pp. 171–180.
- [26] Soldatenko I.S. On genetic algorithm for solving possibilistic optimization problem with mutually Tw-related parameters. Vestnik TvGU. Seriya: Prikladnaya Matematika [Herald of Tver State University. Series: Applied Mathematics], 2008, no. 8, pp. 25–36. (in Russian)
- [27] Soldatenko I.S., Yazenin A.V. Possibilistic optimization problems with mutually t-related parameters. Proceedings of 2008 Annual Meeting of the North American Fuzzy Information Processing Society, NAFIPS 2008, pp. 1–5. doi:10.1109/NAFIPS.2008.4531249.
- [28] Gordeev R.N., Yazenin A.V. A method for solving a problem of possibilistic programming. Journal of Computer and Systems Sciences International, 2006, vol. 45(3), pp. 442–449.

## **Bibliographic citation**

Soldatenko I.S. On solution method for possibilistic optimization problem of one class with parameters characterized by quasiconcave upper semicontinuous strictly unimodal distribution functions. *Nechetkie Sistemy i Myagkie Vychisleniya* [Fuzzy Systems and Soft Computing], 2016, vol. 11, no. 1, pp. 19–32. (in Russian)