

FUZZY APPROXIMATION SYSTEMS AND RELATED STRUCTURES

ALEXANDER ŠOSTAKS

Department of Mathematics, University of Latvia

Zellu iela 8, LV - 1002 Riga, Latvia

Tel.: +371-29109639

Fax: +371-67033701

E-mail: *sostaks@lanet.lv*

In 1968, that is only 3 years after L.Zadeh has published his famous work "*Fuzzy Sets*" [9] thus laying down the principles of what can be called *Mathematics of fuzzy sets*, his student C.L.Chang [1] introduced the concept of a fuzzy topological space thus marking the beginning of Fuzzy Topology, the counterpart of General Topology in the context of fuzzy sets. Later this concept was developed in various directions, see e.g. [2], [6], [8], [7]. Now Fuzzy Topology is one of the most well developed fields of Mathematics of fuzzy sets, and there are dozens of fundamental works on this subject.

In 1983 Z. Pawlak [5] has introduced the concept of a rough set which can be viewed as a certain alternative of the concept of a fuzzy set for the study of mathematical problems of applied nature. Pawlak's work was followed by many other researchers where rough sets and mathematical structures on the basis of rough sets were introduced and studied.

Although it may seem that the concepts of a fuzzy set, of a (fuzzy) topological space and of a rough set are of an essentially different nature and "have nothing in common", this is not the case. Probably, the first one to start studying the intermediate relations between topologies, fuzzy sets and rough sets was J. Kortelainen [3], see also subsequent his and co-authors papers [4], etc.

The aim of this work is to present an alternative view on the relations between fuzzy sets, fuzzy topological spaces and rough sets. In order to realize this aim we introduce the concept of an approximative system (first defined in our talk at the conference FSTA - "Fuzzy Sets: Theory and Applications" in 2008 in Liptovsky Jan, Slovakia) and thus come to the category **AS** of approximative systems. The properties of this category are studied and the connections between the category **AS** and its subcategories related to fuzzy topology, fuzzy sets and rough sets will be discussed.

REFERENCES

- [1] C.L. Chang . Fuzzy topological spaces . *J. Math. Anal. Appl.* , **Vol. 24**, 1968, 182-190.
- [2] J.A. Goguen. The fuzzy Tychonoff theorem . *J. Math. Anal. Appl.* , **Vol. 43**, 1973, 734-742.
- [3] J. Kortelainen. On relationship between modified sets, topological spaces and rough sets. *Fuzzy Sets and Syst.*, **Vol. 61**, 1994, 91-95.
- [4] J. Kortelainen, J. Järvinen. A unified study between modal-like operators, Topologies and Fuzzy Sets. *Turku Centre for Computer Turku, Finland, Technical Reports*, **Vol. 642**, 2004.
- [5] Z. Pawlak. Rough sets. *International J. of Computer and Information Sciences*, **Vol. 11**, 1982, 341-356.
- [6] A. Šostak. Basic structures of fuzzy topology, . *J. Math. Sciences*, **Vol. 78**, 6, 1996, 662-701.
- [7] S.E. Rodabaugh. A categorical accomodation of various notions of fuzzy topology, . *Fuzzy Sets and Syst.*, **Vol. 39**, 1991, 241-265.
- [8] Ying Mingsheng. A new approach to fuzzy topology, Part I., *Fuzzy Sets and Syst.*, **Vol. 9**, 1983, 303-321.
- [9] L.A. Zadeh. Fuzzy Sets., *Inform. and Control*, **Vol. 8**, 1965, 338-365.