

東北大学大学院情報科学研究科
純粋・応用数学研究センター
情報数理談話会のお知らせ

日 時：2015年3月6日(金) 13:30 – 15:50

(会場にお茶を用意しております)

場 所：東北大学大学院情報科学研究科棟 2階大講義室

[第一部] 13:30 – 14:30

講演者：Stavros Iliadis 氏 (Moscow State University)

題 目：Topologically and isometrically universal spaces

[概要] (別紙をご覧ください)

[第二部] 14:50 – 15:50

講演者：Alexey Tuzhilin 氏 (Moscow State University)

題 目：Optimal networks: Introduction

[概要] We discuss general mathematical theory of optimal connection between given terminal cites. Classical school-level case is called Steiner Problem and asks to construct a shortest network (connected planar graph) joining a given finite set of points in the Euclidean plane. A huge amount of papers is devoted to algorithms constructing such networks, strictly or approximately. There are two main reasons of that: first, this problem has various applications, and, second, the problem is NP-hard. Our approach based more on investigation of geometrical properties. One of typical questions is to find out the relation between the combinatorial structure of possible solutions and geometrical properties of the both boundary sets and ambient spaces. In our talk, we give an introduction to the theory of optimal networks. We discuss general approaches to the Steiner Problem by changing the Euclidean plane with various metric spaces, in particular, with Riemannian manifolds, or surfaces of polyhedra, or normed spaces. Besides that, we consider various optimization criteria by changing the “shortest” with local minimal (shortest in the local sense), or, inside out, with the shortest among all possible isometric embeddings of a given terminal set into ambient spaces (one-dimensional branched minimal fillings in M.Gromov sense). Such generalizations, for example, give us possibility to take up optimal networks with cycles, what have applications in multi-dimensional world (minimal surfaces, Plateau problem, etc.). In spite of the long history, this area contains many unsolved difficult problems. In the end of the talk, we formulate a few of them.

TOPOLOGICALLY AND ISOMETRICALLY UNIVERSAL SPACES

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Let \mathbb{M} be a class of topological (resp. metric) spaces. A space T is said to be *topologically* (resp. *isometrically*) *universal* in \mathbb{M} if $T \in \mathbb{M}$ and for each $X \in \mathbb{M}$ there is a topological (resp. an isometric) embedding of X in T . If $T \notin \mathbb{M}$ then T is said to be *topologically* (resp. *isometrically*) *containing* space for \mathbb{M} . The problem of the existence of universal elements actually can be put for any class of spaces. This problem for different classes of spaces are considered by many authors. There are many open problems concerning universal elements (see for example [2]).

In the talk we will consider the method of construction of topologically and isometrically universal and containing spaces given in [1]. This method is almost set-theoretical and can be used as well as for the construction of different universal objects (G-spaces, mappings, topological groups (see [8]), lattices (see [3],[7])). We will focus our attention in the classes of separable metric spaces (see [4], [5], [6]) and in the classes of (non-separable) topological groups.

REFERENCES

- [1] Iliadis S.D., *Universal Spaces and Mappings*, North-Holland Mathematics Studies 198, 2005, pp. xvi+559, Elsevier Science B.V., Amsterdam, xvi+559 pp.
- [2] Iliadis S.D., *Some problems on isometrically universal spaces*, Proceedings ICTA , 2011, Islamabad, Pakistan, Cambridge Scientific Publishers, 2012, pp. 231-241.
- [3] Dube Th. Iliadis S., van Mill J., Naidoo I., *Universal frames*, Topology and its Applications, Vol. 160 (2013), No. 18, pp. 2454-2464.
- [4] Iliadis S.D., *A separable complete metric space of dimension n containing isometrically all compact metric spaces of dimension n* , Topology and its Applications, Vol. 160 (2013), No. 11, pp. 1271-1283.
- [5] Iliadis S. and Naidoo I., *On isometric embeddings of compact metric spaces of a countable dimension*, Topology and its Applications, Vol. 160 (2013), No. 11, pp. 1284-1291.
- [6] Stavros Iliadis, *On isometric embeddings of separable metric spaces*, Topology and its Applications, Vol. 179 (2015), pp. 91-98.
- [7] Stavros Iliadis, *Universal regular and completely regular frames*, Topology and its Applications, Vol. 179 (2015), pp. 99-110.
- [8] Stavros Iliadis, *On embeddings of topological groups*, Appear in the journal Fundamental and Applied Mathematics, (Russian).