

The aim of the project is to study some classes of spaces and their self-maps using the methods of algebraic topology. The general scheme of such investigation is the following: first we choose some topological space that is in the scope of our interest, then we build an algebraical objects associated with that space, next we do some algebraical manipulations on these objects and finally translate the obtained results back, expressing them in the language of topology of the space. In this way we could substantially increase our knowledge about the space and its self-maps.

The algebraical objects we consider within this project are so-called "topological invariants", that are very useful tools in topology and dynamical systems. The project is devoted to application of known invariants and building new-ones in order to reveal the properties of important classes of spaces (compact manifolds, Lie groups, surfaces, polyhedra) and their self-maps.

The project will be divided into the following complementary tasks.

(1) The study of the "tools", i.e. establishing the properties of topological invariants (also constructing new types of invariants).

(2) Application of the invariants to study the self-maps of the given spaces, in particular the structure of fixed and periodic points.

(3) Finding topological characterization of the spaces in terms of numerical invariants related to the equivariant maps.

(4) Constructing algorithms that enable to determine the invariants and computing them by a use of computer programs.

We will apply advanced apparatus of algebraic topology including the methods of homology and homotopy theory. In the part related to the computations of the invariants we will use combinatorial methods based on partitions and computer programs created especially for the project.

The motivation of undertaking the project originates from some open problems posed in the recent years by leading mathematicians. The expected results, connected with (among others) the structure of periodic points may be of interest to a vast part of the mathematical community, while our development of the "devices". i.e. creating new invariants and showing their properties should be useful within topology and dynamical systems. Thus, we hope our project will have considerable impact on these areas of mathematics, and its results will be applied in many further investigations.

What is more, some results of our project could be successfully applied also in other branches of sciences, especially in physics and game theory. Namely, the obtained theoretical results could be translated into solutions of some important problems arising in these sciences.

Both Chinese and Polish teams have a long tradition of meetings and informing each other about the progress of the conducted investigations. The project "Sheng" would be a great chance to establish long-term collaboration on stable basis. We do hope that our project will also support the scientific career of young scientists, who will benefit from cooperation with more experienced partners from abroad. The competencies of the members of both teams fit very well one to another, we have the common area of interest and long history of discussions on open problems and the topics described in the project. Now working together we could face much more ambitious challenges, solving the problems that we could not solved alone.