The proposal refers to the problems related to the research within the mathematical analysis in the space of several complex variables. In many problems the transfer from the classical (real) mathematical analysis to the complex analysis enables us to prove and to understand the phenomena which would remain mysterious without this transfer. It may already be seen in so basic problems as the ones related to the study of the properties of polynomials and number series which is taught in the beginning of the studies.

In complex analysis many natural objects have very regular properties. This is different from the real case. The key fact in the considerations within the complex analysis is that many domains (in particular, the convex ones) are identical (meaning conformal or biholomorphic) with the unit disc - it is the Riemann mapping theorem (from the 19th century). In the case of several complex variables the analoguous theorem does not hold (the example of Poincare was given about a hundred years ago). This makes the need of classification of identical in the sense of the complex analysis (i. e. biholomorphic) domains, which leads to defining some invariants that are preserved under biholomorphic mappings. There are many known objects of that type: functions, distances, quantities - in the project we deal with functions associated with the names such as: Caratheodory, Kobayashi, Bergman, Lempert; squeezing function. One of the fundamental results showing that one may, to some extent, speak of the theorem analogouous to the Riemann mapping theorem in the case of several complex variables is a result of Lempert (dating back 30 years) which states that in the class of convex domains many out of naturally considered invariant functions are identical.

The aim of the project is, among others, the study to which class of domains a result of Lempert may be generalized. The reasonable conjecture is that the class of **C**-convex domains - a class of domains being a certain complex generalization of convex domains. Also the study of the properties of hoplomorphically invariant objects is an important in our project. A research on the existence of functions with given in advance boundary properties on a natural (in the complex analysis) families of domains (e. g. pseudoconvex ones) is also essential in the project.
Another element of the planned research is the application of the methods of complex analysis in the study of the spectacular (very irregular) real objects: nowhere differentiable continuous functions whose existence is known since the 19th century.

The topics covered in the project are important in the theory of functions of several complex variables and they are often related to the problems considered by the most known specialists working in complex analysis (e. g. problem of Diederich-Ohsawa, Suita conjecture). The results concerning these problems appear in the most important mathematical journals (Annals of Mathematics, Inventiones Mathematicae) soany progress in that field would be interesting for a class of outstanding mathematicians. On the other side the continuous, nowhere differentiable functions fascinate the mathematicians since the proof of their existence - the systematic presentation of the theory theory related to them would definitely attract the interest from a wide variety of mathematicians (and other scientists) being specialists in different fields of mathematics.