The project is devoted to the elaboration of a new method to analyse multistable dynamical systems. System is multistable if we can observe qualitatively different types of behaviour without any change in parameter values or the system itself. In multistable systems we can observe sudden changes of system behaviour due to even small perturbances or noise. Such feature is commonly met in all types of models originating from different disciplines of science. For example its was found in the models of machines, smart materials, epileptic seizures, tropical forests vegetation and cancer drug resistance.

Analysis of multistable systems induce many fundamental questions: What are the possible responses of the system? What is the most probable behavior of the system? What and how can cause the transition to a different state? How big perturbations can given solution “survive”? and etc.
There are multiple methods to analyze multistable systems dynamics. Classical methods enables good understanding of the dynamics but are difficult to apply, especially for complex modes with multiple dimensions. All the novel approaches focus on different aspects and describe specific features of multistability. Moreover, all these measures requires different computational algorithms and large computational effort. That is why, even nowadays when we can use fast computers. analysis of multistable system if a hugely challenging tasks.

The aim of the project is to develop a novel, universal sample based approach for analysis of multistable dynamical systems to simultaneously investigate different stability indicators. The method will allow to estimate, in one procedure, multiple classical stability measures and novel markers. The method will be developed basing on the analysis of real world engineering problems and include aspects that are important for practical applications.

The method will be applicable for wide range of systems originating from various disciplines such as engineering, physics, medicine or climate sciences. It will be straight forward and not require any specific knowledge about classical methods of analysis or bifurcations. Thanks to the above features, the developed method will be efficient, versatile and robust and it will help to expand the knowledge on multistable dynamical systems.