

Have you ever noticed a sign that says “Fuzzy Logic”? More and more often it is possible to find it on a washing machine at your neighbors’ or on a dryer, dishwasher, rice cooker or photo camera as well. It means that an electronic system used in it is based on fuzzy logic. The development and improvement of such systems are expected results of this project.

Fuzzy system is one possible solution in all those situations in which we deal with non-accurate or not certain data and at the same time we accept unprecise results or decisions. That is in all those situations that previous systems weren’t very effective and making a decision was remaining in human hands — because isn’t Grandma, who takes a look at a laundry and decides in a split second how much washing powder she should put into the washing machine, more effective than a complex system that after performing long calculations finds result that differs from Grandma’s scoop by only a little bit? The concept of following human ways of making decisions, that is unprecise but often effective, lays at the heart of fuzzy systems. The next advantage of broadly defined computational intelligence — and methods based on fuzzy logic are in this group — is its speed. Pretty often we know exact mathematical or physical methods that solve a problem, but it takes a lot of time to perform all calculations and it is not practical.

The goal of the project is a continuation of research on such properties of fuzzy systems that may let engineers, projecting various devices using mentioned methodology, use optimally well known algorithms of approximate inference. Mathematical base of fuzzy systems is a multivalued logic, where among others we use different generalizations of classical logic connectives known from high school: conjunction, disjunction, negation or implication. Our studies mainly focus on the properties of multivalued implications that are called fuzzy implications in the literature. The main scientific goal of the project is to describe considered fuzzy logic methods in the language of mathematics, by functional equations and inequalities. Then to solve those equations and inequalities and to provide specific formulas and conclusions useful for applications. Our research will not be limited only to control systems based on fuzzy logic but they will deal with other issues as well — for instance with computer graphics that multivalued connectives are being used in.