Electric drives play an extremely important role in everyone's life. To illustrate the scale of the impact of the drives in the life of societies, the statistics can be used on the amount of energy they consume. From presented, commonly available data suggests that as many as 42% of the total electricity consumed on Earth is the energy consumed by the industry in which the shares represent just 2/3 of electric drives. On a global scale while drives use 28% of the energy produced in the absolute scale gives it over 7 000 TWh per year – for comparison, it would have sufficed for 42 years of continuous power throughout the Poland. Second in order of class power consumers – lighting consumes less than half the energy of drives. It is therefore particularly important to make research in the field of electric drives.

Electric drive is understood here as a monolithic block of functional processing electrical energy into mechanical (in rotation or linear movement), which includes customary motor, power bridge and control system. There are implemented more or less complex algorithms in the controller for conditioning the operation of the drive – and in particular the implementation of a strict regime of energy expenditure in the set with the load – which is often a complex mechanical system, eg. on the assembly, production line (as the drive of industrial robots, conveyors, compressors of air conditioning and ventilation). Electric drives are often a key component of household appliances (vacuum cleaner, refrigerator, freezers, food processors) are common even in computers (eg.Hard or optical drives) .

Switched Reluctance Motor (SRM) drive is a special type of drive, with some unique properties. With a simple, monolithic design can reach very high speeds – even above 100 000 rpm (linear velocity of reaching the speed of sound) and operate in difficult environmental conditions (high dust, significant fluctuations in temperature, immersion in liquids). Interestingly, the first electric locomotive in the world, built in 1837 by Robert Davidson was based on a switched reluctance motor. Unfortunately, the then unknown semiconductor technology has forced mechanical control solutions, which are rapidly degraded or damage (mainly due to high over-voltages in intermittent circuits).

Only the rapid development of semiconductor technology, production of integrated circuits of high level enabled the practical implementation of a relatively complicated control dedicated for switched reluctance motor. The primary complication is the engine nonlinearities and the need to work in a closed loop with a dedicated inverter (which implies eg. the fact that it is impossible to work this motor with direct connection to the mains). This implies next the need to develop complex control algorithms, among others, including those of nonlinearities. The research project focuses on that aspects, aspects of advanced control system design.

The uniqueness of the proposed solutions for the development of algorithms and control structures is an approach in which the author's model of motor will be used in the control system (in normal operation and in terms of damage) not only to improve the quality of the controls, but also for the fault detection process. This concept can be visualized in such a way that the reference model is used in a control system for determining the operating state, which allegedly should be as similar to the state of the actual controlled object. Variations of these determinations in the general case can be used for various purposes, as well as parameters of the model are undergoing the process of adaptation. First of all, the reversal of non-linearities in the control circuit allows to compensate for object nonlinearities to simplify the process of selecting effective in a wide range of operating conditions regulators. The reference model allows the implementation of sensorless control and thus reducing the complexity of the system (no need to use an angular position sensor), implementation of optimal control (ie. energy-efficient).

Above all, the control system by comparing the current waveforms measured directly in the real engine of those with estimated using the reference model by recognizing the characteristic deviations will be able to identify the type of damage. Because these relationships can be very complex and difficult to describe directly by the analytical equations, it is planned to use methods of artificial intelligence (neural networks or fuzzy-neural networks).

Implementation of the model adaptation system allows to obtain high accuracy of the system and reduces the need for laborious and time-consuming manual identification of each of the connected motor. Minimizing the complexity of operating system in the target implementation of the research results will contribute to increase the commercial value of research results. Examining three structures converters (simplified *c-dump*/*r-dump*, *asymmetrical* and classic – *symmetrical*) – including two with the possibility of partial system redundancy will contribute to a broad examination of their properties in terms of working conditions, damage and the classification of these structures due on selected criteria.