

## Brushless DC motor for battery-electric trucks

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Modern calculation methods do more possibilities to designers of electric machinery. They allow on development of electric machines as well as upgrade of existing machines and devices. Often upgrading of a motor is much more complicated than designing a new one, as customers impose limitations concerning power supply, price, dimensions, etc. The example of such application of calculation methods is development of a motor for battery-electric truck produced in Poland and designed for transport of various types of materials, with loading capacity of 2000kg. Presently series commutator DC motors are installed in battery-electric trucks. The disadvantage of such motors is their too low efficiency, too big size, and too high noise emission. Hence the need to develop modern motor for battery trucks, with better technical parameters, lesser operational noxiousness, including lesser noise emission. Such requirements can be met by new generations of brushless DC motors featuring i.e. higher efficiency and durability, and lower noise emission than motors currently installed in said vehicles. Works in progress are aimed at development of an electromagnetic brushless six-pole DC motor with a power of 8 kW,  $n = 2200$  rpm. A motor has been designed with predetermined functional parameters, making use of classical circuit models of electromagnetic and thermal phenomena based on the equivalent circuit diagrams. Then motor's magnetic circuit and electric circuit load analyses were performed, making use of field model of phenomena and software, based upon such model, for simulation of brushless motors working states. In resulting algorithm and elaborated programme distribution of magnetic field is determined by means of finite element method and step-by-step algorithm. The analyses accounted for non-linear properties of magnetic materials, eddy currents induced in massive conducting elements and dynamic demagnetisation of permanent magnets. Furthermore motor's semi-conductor power supply system was represented in the calculation programme in approximation. Semi-conductor elements were modelled by means of non-linear resistors of resistance subjected to current and time. Power supply control circuit represented classic brushless motor control algorithm.