MODERN ELECTRICAL MOTORS FOR ROAD AND RAIL VEHICLES

Robert Rossa

PL - 40-203 Katowice
Al. Roździeńskiego 188
Tel.: +48 32 258-20-41
Fax: +48 32 259-99-48
info@komel.katowice.pl
www.komel.katowice.pl
Research and Development Centre of Electrical Machines “KOMEL”, in Katowice, Poland was established in 1948 (state owned). We are the leading Polish R&D company dealing with rotating electrical machines. In this area we have more than 50 years of experience. We design, develop and manufacture prototypes of different type motors and generators (DC, AC squirrel cage, permanent magnet, etc) of output up to 3500 kW.

About 60 engineers and other highly educated staff is employed in Komel (including 1 professor, 5 PhDs).
KOMEL’S SPECIALISATION

Our specialisation is:

§ designing and developing of different type electrical motors (induction motors, permanent magnet synchronous motors, BLDC motors);

§ designing of modern permanent magnet generators;

§ laboratory testing of electrical motors and machines;

§ manufacturing of special type motors and generators.
Most of Polish electric motors were designed in KOMEL Centre.

In KOMEL we worked out projects and documentations of many series of general-purpose electric motors and special electric machines for power plants, coal mining industry, shipbuilding industry, chemical industry, etc.

For example we designed the low and high voltage induction motors which are currently manufactured by different companies in Poland.

Recently we have designed the series of high voltage, energy efficient induction motors for heavy industry and motors for railway locomotives (induction and permanent magnet motors).
So far we have successfully designed:

- permanent magnet synchronous motors;
- brush-less DC motors;
- silent-running induction motors;
- submersible motors for pumps;
- water-cooled, explosion-proof induction motors for coal-mining;
- induction motors for long-starting time and hard exploitation and operating conditions;
- special DC machines for aviation, trams and machine tools;
- high voltage energy efficient induction motors.

All our designs are implemented into production in different manufacturing plants.
EXAMPLES OF ELECTRICAL MACHINES DEVELOPED IN „KOMEL”

Induction motor for Warsaw's Metro (180 kW)

Induction motor for locomotive (830 kW)
LABORATORY OF ELECTRICAL MACHINES

We have modern, very well equipped Laboratory of Electrical Machines. This laboratory has the possibilities to test rotating electrical machines with output power up to 150 kW.

The Laboratory performs different tests of electrical motors and generators during researches and developments of new constructions of these machines as well as tests for our customers.
Electric motors used currently in Electric Vehicles, Hybrid-Electric Vehicles and in Railway Vehicles:

- classical DC motor with mechanical commutator;
- induction motor with squirrel cage;
- brush-less DC motors;
- permanent magnet synchronous motors.
**ELECTRICAL MOTORS FOR ROAD AND RAIL VEHICLES (2)**

**DC motor with mechanical commutator** is a very old solution. The only advantage of this motor type is easy control. There are a lot of disadvantages:
- low efficiency,
- low power (or torque) density from the mass (volume) unit,
- poor reliability, frequent failures, and high operational costs.

**Induction motor with squirrel cage and power-electronic converter** is a currently well-known solution of drive for EVs, HEVs, and rail vehicles. The main advantages of this motor type are low price and high reliability. The disadvantages are:
- low overload capability and low starting torque,
- complicated control algorithms (high computational power required),
- control of speed and torque is not as easy and effective like in the case of other electric motors.
ELECTRICAL MOTORS FOR ROAD AND RAIL VEHICLES (3)

Electric motors with permanent magnets: Brush-Less DC Motors and Permanent Magnet Synchronous Motors (PMSM).

The main advantages:
- the highest efficiency comparing to other electric motors,
- high power (or torque) density obtained from the mass (volume) unit,
- very effective speed and torque control (very good control accuracy),
- high starting torque,
- high reliability.

The main disadvantage is price of magnet material – but it is decreasing each year.

BLDC Motor is in construction very similar to PMSM. The main difference is in control algorithms.
In our opinion the PMSM is the best solution of drive for electric or hybrid vehicles (for roads or rails). Most of our staff is now involved in researches and developments associated with this kind of motors.

High speed PMSMs form Komel are designed as the Interior Permanent Magnet Machines to ensure robustness and reliability.
KOMEL’S SOLUTIONS OF PERMANENT MAGNET ELECTRIC MOTORS FOR ROAD AND RAIL VEHICLES

BLDC Motors for All-Electric Road Vehicles
KOMEL’S SOLUTIONS OF PERMANENT MAGNET ELECTRIC MOTORS FOR ROAD AND RAIL VEHICLES

PMSM Motor for All-Electric Road Vehicles
PMSM Motor for All-Electric Road Vehicles (2)

Reconstruction of the common road vehicles to hybrid or electric vehicles. Komel can deliver solutions of the PMSMs dedicated for this purpose.
KOMEL’S SOLUTIONS OF PERMANENT MAGNET ELECTRIC MOTORS FOR ROAD AND RAIL VEHICLES

Electric locomotive for mining industry

PMSM, BLDC Motors and Induction Motors for Electric Railway Vehicles and Locomotives
For designing of electric motors we use the novel calculation methods and software.

All of our latest constructions of electric motors were developed using Finite Element Method.

Most of the algorithms and software used for the design process of our motors were developed by our scientists and engineers.
PERMANENT MAGNET MOTORS & GENERATORS

On the basis of experience in designing and manufacturing of PMSGens, in 2004 Komel began to manufacture the Permanent Magnet Synchronous Motors (PMSM) and Brush-Less Direct Current Motors (BLDCM) of special purpose. All the algorithms and software used for the design process of these motors were developed by our scientists and engineers. Because of reliability and very competitive price our PMSMs and BLDCMs are often chosen by the designers and manufacturers of modern Hybrid Electric Vehicles (HEV) or Electric Vehicles (EV).

So far we have successfully designed and manufactured a wide range of low power PMSMs or BLDCMs dedicated for HEVs and a few prototypes of higher power PMSMs dedicated for use in the electrical traction rail drives. One of our PMSMs was designed for Polish mining industry. It is used as the main drive of mining locomotive.
Popularisation of renewable energy sources is also the Komel's activity. Komel is the manufacturer of Permanent Magnet Generators. We also designed and built 4 kW windmill. The windmill is intended to be self built by users, especially in agriculture areas.

Permanent magnet synchronous generator type PMGg132M8
CERTIFICATES & AWARDS

In 2005, generators were awarded by Polish Electrical Engineers Association at International Technical Fairs Kielce - ENEX

We work in accordance with ISO 9001
We can design, manufacture and deliver electric motors for environment friendly cars, as well as frequency inverters and control units for such motors.

Our motors are well recognised by our partners (SAM Group, CH; Impact Automotive Technologies, PL; Elipsa Vechicle, PL).
ADDRESSES

Head Office
PL-40-203 Katowice, Al. Roździeńskiego 188
tel.: +4832/258-20-41; fax: +4832/259-99-48
e-mail: info@komel.katowice.pl

Laboratory
PL-41-200 Sosnowiec, ul. Moniuszki 29
tel.: +4832/299-93-81; fax: +4832/299-93-89
e-mail: labor@komel.katowice.pl

Manufacture Plant
PL-41-200 Sosnowiec, ul. Moniuszki 29
tel.: +4832/299-93-81; fax: +4832/299-93-89
e-mail: zaklad@komel.katowice.pl

www.komel.katowice.pl