

ELECTRONICALLY COMMUTATED MOTORS FOR FAN APPLICATIONS

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Abstract - An important market for electronically commutated (EC) motors are fan applications, where low acoustic noise is of increasing importance. External rotor motors are especially advantageous for space-saving fan-motor-units. The acoustic noise of the motor can be influenced considerably by the commutation strategy. The commutating process has been analyzed using space vectors. Motor noise has been reduced significantly using new modulation strategies.

1. MOTORS FOR FAN APPLICATIONS

External rotor motors in which the cowl-shaped rotor revolves around the stationary stator are often used in fan applications. Their stator winding can be produced with an NC winding machine or with a very fast flyer technology, depending on the wire diameter. The single tooth winding produces an extraordinary short winding head length thus allowing space-saving design and reduced copper losses.

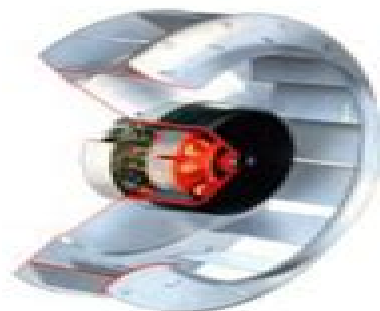


Fig. 1: Centrifugal fan with external rotor motor

The motor shaft is integrated into the rotor construction. For centrifugal fans (Fig. 1), the external rotor motor can be fitted inside the fan impeller itself. For axial fans, the blades can be directly mounted on the rotor (Fig. 2). Both versions result in a space-saving fan-motor-unit. The firm connection between all rotating parts in a fan also ensures accurate balancing. As a result, the rotor bearings experience lower stresses. In addition, the motor is positioned straight in the air stream, providing better overall cooling, which extends lifetime of the machine.

Conventional (brushed) DC motors can be utilized only with fans for relatively few operating hours. Switched reluctance machines are not preferred because of their poor noise behavior. Therefore, mainly single-phase or three-phase induction and EC motors are used as a fan drive. EC motors, also called brushless DC (BLDC) motors, have some major technical advantages: high energy density, high efficiency, wide speed range, easy speed controllability, and long lifetime expectancy.

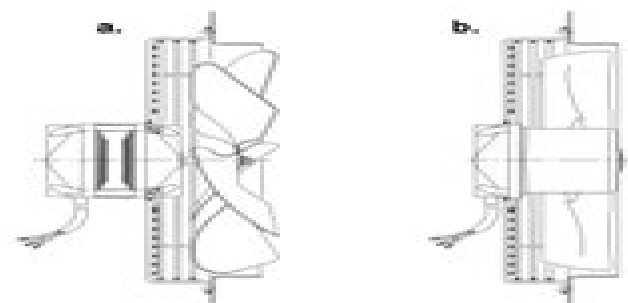


Fig. 2: Axial fan with internal rotor motor (a) and with a space-saving external rotor motor

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