Chapter 10
Applications of DC Motors

ABSTRACT

This chapter gives the motivation behind using direct current machines and its application in various domains. The authors start discussing the applications of DC machines in toys, disk drives Steel rolling mills, Paper machines, Generator, Electrical Propulsion, Cranes, CD/DVD players, Electric vehicles, RC Vehicles, UAVs, Cement Plants, and Aircraft applications. They then provide a case study on the application of DC Chopper Motor Drive. They conclude the chapter by discussing the use of D.C. Series Motors in Electric Traction.

INTRODUCTION

Direct current (DC) machines have numerous applications. These applications range from our daily life to spacecraft applications. In our daily life, they are used in printers, fuel pumps, and electric vehicles. While in spacecraft applications, they are used in solar airplane, electric aircraft, and propulsion systems. In Figure 1, we show DC machines its applications. Table 1 shows the application of DC Machines along with their DC Motor Type and References.

MEDICAL APPLICATIONS

The Brushless DC Motor (BLDC) has made his place in medical applications as well. This is primarily due to low cost an accurate precision. Here we discuss two major applications of Brushless DC Motors in two major applications areas. The first application is in Sleep Apnea Treatment and the second application is in Medical Analyzer.

Application Area 1: Sleep Apnea Treatment

Sleep Apnea is a disease in which patient has problem of breathing during sleep [Wikipedia]. Positive Airway Pressure (PAP) respirators are used for the treatment of this disease. In majority of PAP respira-

Figure 1. DC Machines and its applications
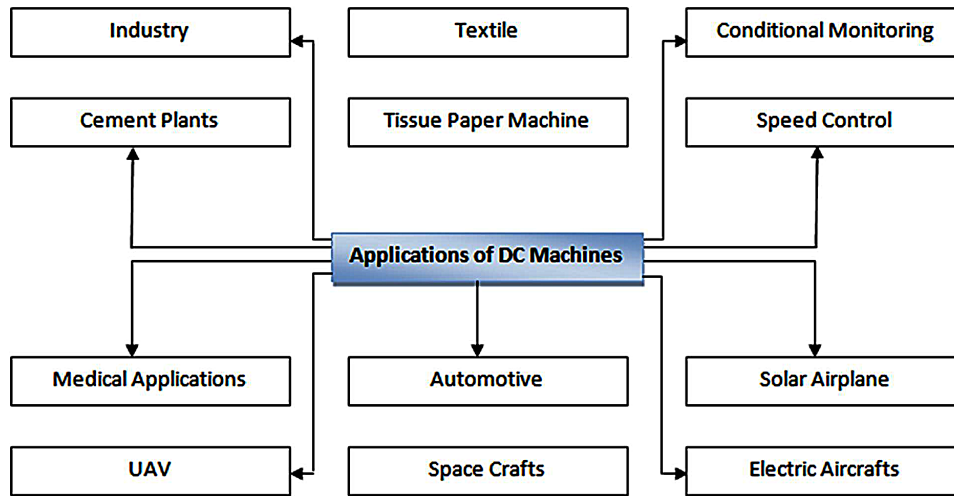
tors, BLDC motor is used in order to drive the blower fan. This blower fan helps the patient in breathing during their sleep and adapts its speed according to the patient's airway pressure. More air is required when the patient inhales and when the patient exhales, less air should be required. Thus, the BLDC motor should increase or decrease its speed with respect to inhaling and exhaling. The use of Sensorless BLDC motor is highly appropriate in Sleep Apnea Treatment because the motor is not required to operate below the minimum threshold speed of the drive. Additionally, since there is no risk of sudden change in the load, therefore, Sensorless BLDC motors suits well for these sorts of applications.

However, since we are operating in a Hospital environment, thus, we need to produce less noise for the patients comfort. And Sensorless BLDC motors suits well in this scenario. Two conclusion have drawn by for the use of brushless DC motors compared to brushed DC motors. The first is that the brushless DC motors provide greater amount of torque and the second one is that they have higher heat transfer efficiency. Another advantage of using brushless DC motors in medical applications is that they do not have brushes, which in fact increase the reliability and consequently increase the overall life of the motors.

Application Area 2: Medical Analyzer

Medical Analyzer is a machine which is widely used now a day in many hospitals for the automatic testing of blood and urine. These medical analyzers test hundred of urine and blood samples in a month and all the operation is automatic. In these medical analyzers, stepper motors are used.

Solar Tracking Applications

In solar tracking, the position of the sun is tracked. Solar tracking is required for getting the maximum energy and this is achieved through changing the position of the solar panel in accordance with the movement of sun (Lam et al., 2012). To move the solar panel with sun, DC motor driver is required. This DC motor driver will control the direction as well as the speed of the solar panel. The total number of solar panels which can be mounted on the solar tracking system is dependent on the torque of the

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