

Abstract

Speed control of electrical motors plays an ever-increasing role in both industrial and domestic applications. One of the main reasons for this is the increased focus on energy savings. For the circulator pump, which is the application in focus in this thesis, large savings can also be obtained by controlling the speed of the pump. In practice controlling the speed of the driving motor, which in most cases is an induction motor, does this. Simple methods for speed control of induction motors are therefore a necessity in order to obtain a widespread use of controlled pumps, because the control unit has to be inexpensive. The objective of the research project, which is documented in this thesis, is to Design and development of DSP based variable frequency drive.

In the past, variable-speed drives employed predominantly dc motors because of their excellent controllability. However, modern high performance motor drive systems are usually based on three-phase ac motors, such as the ac induction motor (ACIM) or the permanent-magnet synchronous motor (PMSM). The principles of vector control are now well established for controlling these ac motors; and most modern high performance drives now implement digital closed-loop current control. In such systems, the achievable closed-loop bandwidths are directly related to the rate at which the computationally intensive vector-control algorithms and associated vector rotations can be implemented in real time. Because of this computational burden, many high performance drives now use digital signal processors (DSPs) to implement the embedded motor and vector-control schemes. The inherent computational power of the DSP permits very fast cycle times and closed-loop current control bandwidths (between 2 and 4 kHz) to be achieved.

The complete current control scheme for these machines also requires a high-precision pulse-width modulation (PWM) voltage-generation scheme and high resolution analog-to-digital (A/D) conversion (ADC) for measurement of the motor currents. In order to maintain smooth control of torque to zero speed, rotor position feedback is essential for modern vector controllers. Therefore, many systems include rotor-position transducers, such as resolvers and incremental encoders. A DSP based controller section of a single-phase ac Drive is proposed in this thesis. The DSP is ADMC326, which is combining an integrated DSP controller, with a powerful DSP core, flexible PWM generation, high-resolution A/D conversion, and an embedded encoder interface.