

ANALOG TO DIGITAL CONVERSION RESOLUTION ENHANCEMENT OF MICROCONTROLLERS USING DYNAMIC VOLTAGE REFERENCES

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ABSTRACT

Resolution of an Analog to Digital Conversion module of a General purpose Microcontroller is limited 8-12 bits. Therefore for applications where high precision is needed, a microcontroller's ADC module's resolution is not sufficient. Using the "Dynamic Voltage Reference Method", it is possible to enhance the resolution of the ADC Module at the cost of conversion speed.

Key words: ADC, Analog to Digital, Resolution

1. INTRODUCTION

Analog to Digital Conversion (ADC) modules of general purpose microcontrollers have resolutions of 8 to 12 bit which is sufficient for most control applications where high precision is not a concern. But for applications, such as accurate voltage or current measurements or precise control of manipulators using potentiometers demands higher resolution and the microcontrollers fail to deliver that. Therefore standalone ADC chips should be employed in those applications which is a more expensive option. But most of microcontrollers have voltage reference inputs for their ADC modules with which voltage scale can be varied apart from its default logic low to high voltage scale. Using dynamic voltage references, much higher resolution can be achieved than its original resolution. Dynamic voltage reference method can be used with PID controls effectively for precise control applications. Since effective ADC conversion speed is reduced, this method is more suitable for high accurate applications where acquisition time is not a concern.

Voltage references can be varied during the runtime of the program using the two DAC modules as shown in the figure 1 and it should be taken into account that the conversion speed of the

DAC module is a factor that decides the overall performance of the system. And also the resolution of the DAC module affects the effective resolution of the Analog to Digital Conversion. As the ADCs, DACs with higher resolutions are much expensive, but even with cheaper 8bit DACs the effective resolution of the system can be increased to a maximum of eight times the current ADC resolution which is a much cheaper alternative than using an ADC chip that has a higher ADC resolution. Some new microcontrollers are equipped with built-in DAC modules which makes the system more simple.

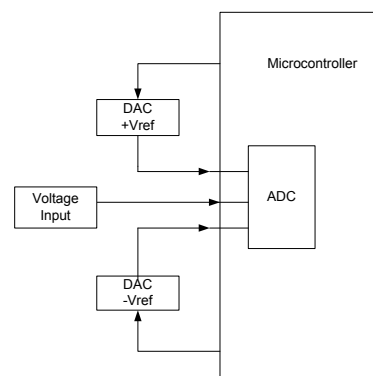


Fig1. Circuit for Dynamic Voltage References