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A variable frequency drive (VFD)

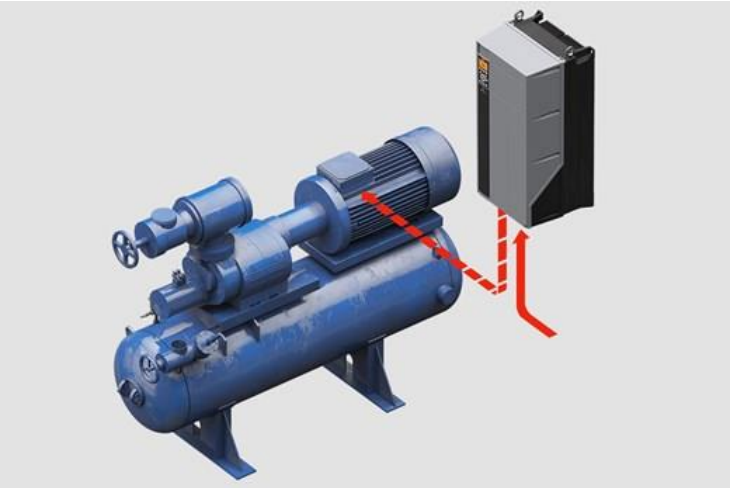
Description:

A variable frequency drive (VFD) is a type of motor controller that drives an electric motor by varying the frequency and voltage of its power supply. The VFD also has the capacity to control ramp-up and ramp-down of the motor during start or stop, respectively.

Even though the drive controls the frequency and voltage of power supplied to the motor, we often refer to this as speed control, since the result is an adjustment of motor speed.

There are many reasons why we may want to adjust this motor speed.
For example, to

- Save energy and improve system efficiency
- Convert power in hybridization applications
- Match the speed of the drive to the process requirements
- Match the torque or power of a drive to the process requirements
  Improve the working environment
  Lower noise levels, for example from fans and pumps
- Reduce mechanical stress on machines to extend their lifetime
  Shave peak consumption to avoid peak-demand prices and reduce the motor size required

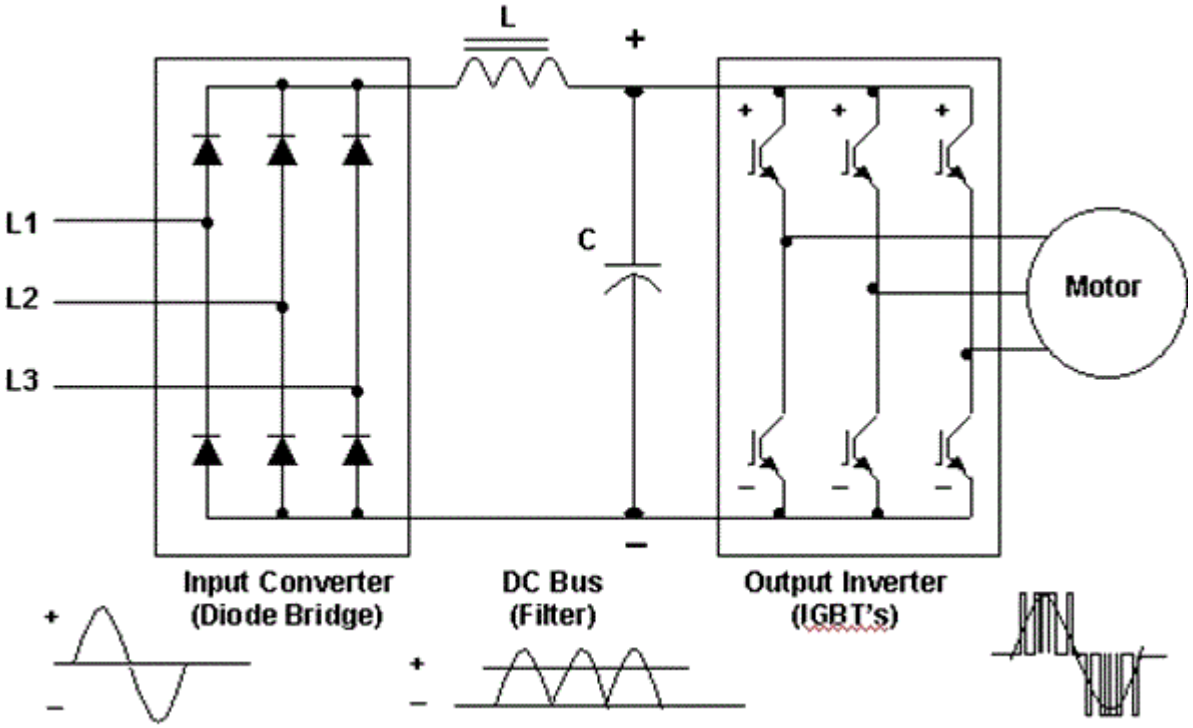


In addition, today's drives integrate networking and diagnostic capabilities to better control performance and increase productivity. So, energy savings, intelligent motor control and reduction of peak-current drawn are three great reasons to choose a VFD as the controller in every motor-driven system.

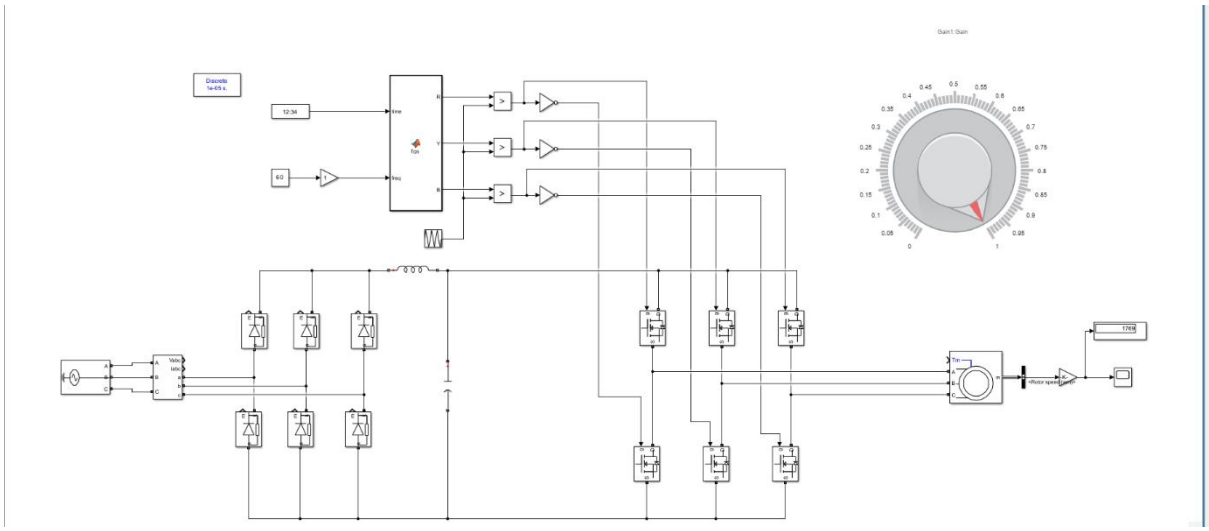
The most common uses of a VFD are for control of fans, pumps and compressors, and these applications account for 75% of all drives operating globally.

Soft starters and across-the-line contactors are other, less sophisticated types of motor controllers. A soft starter is a solid-state device and provides a gentle ramp-up to full speed during startup of an electric motor.

Basic Circuit of VFD is shown below: -

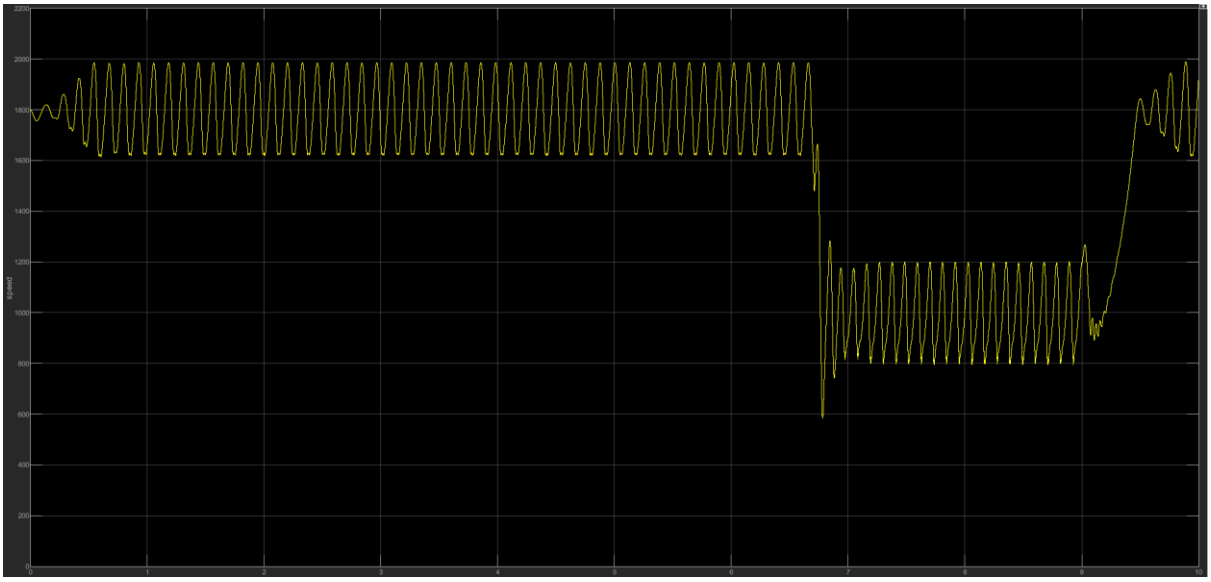


By referring above circuit, I had built MATLAB simulation circuit, is shown below:



Input 3-phase is rectified to DC using diode rectifier. The DC output is filtered and gave as input to 3-phase Inverter. Basically, MOSFET is used as a switch for Inverting circuit. Switching is controlled using math function. The inverted 3 phase is connected to Asynchronous motor.

Below figure shows the graph of speed V/S time. Initially gain will be 100% and at time is equal to 6.5sec frequency gain changed to 55% where frequency also changes with gain. At this time speed of Asynchronous motor connected as load will also changes.



Script used for switching of MOSFEST

```
function [R,Y,B] = fcn(time,freq)
omega=2*pi*freq;

R=sin(omega*time)*freq/60;
B=sin(omega*time+120*pi/180)*freq/60;
Y=sin(omega*time+240*pi/180)*freq/60;
```

Reference:

1. https://www.electrical4u.com/variable-frequency-drive/
2. https://www.danfoss.com/en-in/about-danfoss/our-businesses/drives/what-is-a-variable-frequency-drive/
3. https://en.wikipedia.org/wiki/Variable-frequency_drive

THANK YOU