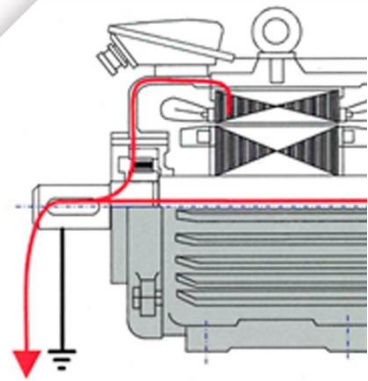


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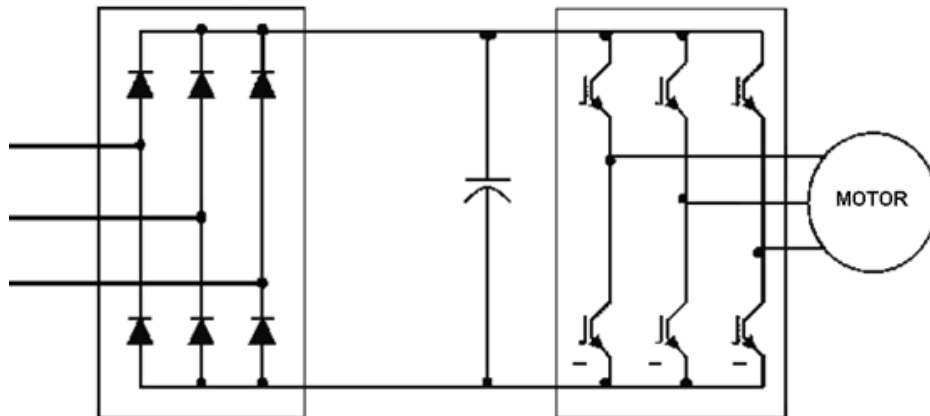
Harmonic Currents and Shaft Voltages in Asynchronous Motor Bearings

DİDEM ERGUN SEZER

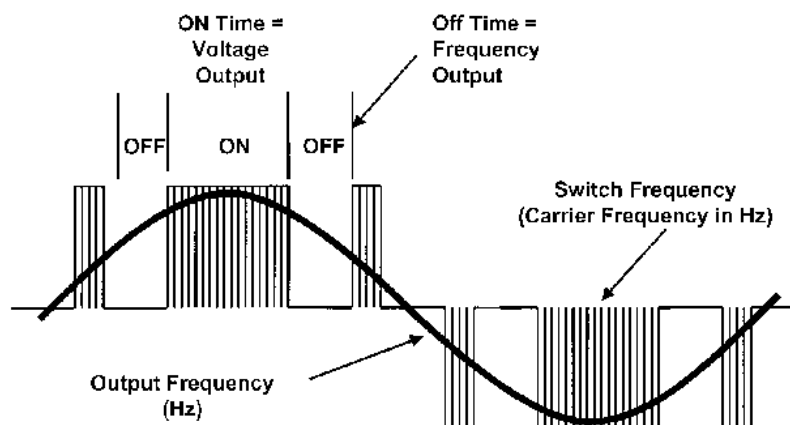


HARMONIC CURRENTS AND SHAFT VOLTAGES IN ASYNCHRONOUS MOTOR BEARINGS

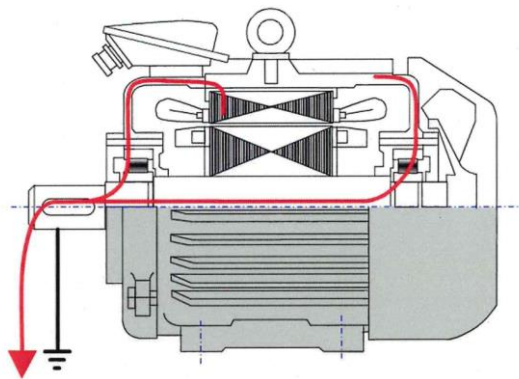
Asynchronous motors are commonly used in the industry with variable frequency drives. Pulse-width modulation inverters are widely employed for this purpose, offering high energy efficiency, precise motion control, high starting torque, and low starting current.



At the input stage of the variable frequency drive, a DC voltage is obtained via a 6-pulse diode rectifier circuit to generate a DC bus voltage. The inverter circuit utilizes semiconductor switches and operates based on pulse-width modulation. These semiconductor switches switch at specific frequencies and pulse patterns to achieve the desired output voltage magnitude and frequency. The PWM principle aims to produce a sinusoidal voltage at the fundamental frequency by maintaining a constant switching frequency while adjusting the width of the inverter output voltage pulses.



The sinusoidal wave produced by PWM inverters is not a pure 50Hz waveform. Asynchronous motors are designed to operate with a three-phase pure sinusoidal waveform, where the neutral point is zero volts. However, when using PWM in three-phase power supplies, it becomes challenging to maintain balance between phases, creating potential for leakage current between the output of the variable frequency drive and ground through leakage impedance in motor windings and cables. This current flowing to the ground is referred to as "Common Mode Current."

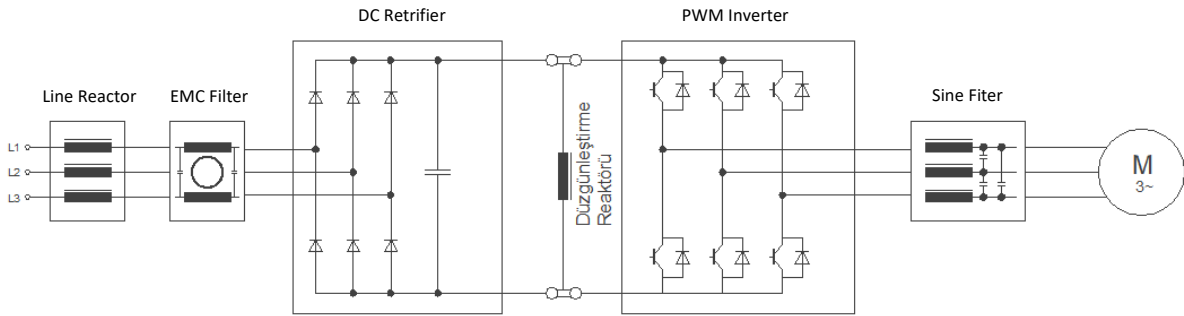


The pulsed voltage produced by the variable frequency drive contains high frequencies, causing leakage currents to flow from the motor winding's capacitance to ground. This results in voltage induction between the shaft ends. If this induced voltage is strong enough to overcome the impedance of the oil layer on the bearings, high-frequency bearing currents will flow. These currents typically pass through the bearings due to their low impedance path. The damage caused by these bearing currents can be detected through deterioration of ball bearings and a change in color of their surfaces to a matte gray shade.



Installing a sinusoidal filter between the variable frequency drive and the motor helps prevent bearing damage and reduces production losses caused by bearing failure.

Ideal Type of Connection :



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