



Induction Motor Control With Small DC Link Capacitor Inverter Fed By Three Phase Diode Rectifier

K S Manimala*¹, D Srinivas Rao²

M.Tech Student, Department of EEE, KIET, Kakinada, India.¹

Asst. Professor, Department of EEE, KIET, Kakinada, India.²

Abstract

This venture enhances the unwavering quality and power thickness of three stage variable speed drives by controlling presents a little film capacitor inverter based acceptance engine control . A hearty half and half engine controller is created to counteract execution corruption caused by the electrolytic capacitor-less inverter sustained by front-end diode rectifiers. The structure of the controller consolidates a model-based controller (MBC) and a hexagon voltage controlling controller (HVC). The MBC decides the order yield voltage with the convergence of the torque and rotor flux linkage charge. In the HVC mode, the order voltage vector is resolved just by the torque charge and the hexagon-formed inverter voltage limit. Fruitful utilization of the control approach is substantiated by a graphical and diagnostic implies that actually prompt a solitary voltage choice run the show. This paper additionally looks at the operation affectability under engine parameter floats to decide how to decouple its impact utilizing a voltage unsettling influence state-channel plan. This venture enhances the yield voltage and smoothening wave shapes by utilizing fluffy controller than PI controller. The outcomes checked through MATLAB/SIMULINK condition.

Index Terms—Front-end diode rectifiers, hexagon voltage controlling controller (HVC), model-based controller (MBC), little film capacitor inverter, three-stage variable speed drive.

1.INTRODUCTION

In ease three-stage variable speed drive applications, for example, warming ventilating-aerating and cooling (HVAC) frameworks, diode rectifiers are generally utilized as the front-end circuit for non regenerative ac-dc change as a result of their lower cost and higher dependability. In these sorts of minimal effort air conditioning drive frameworks, aluminum electrolytic capacitors are usually used to adjust the contrast between the quick information and yield control and additionally

stifle the voltage spikes caused by spillage inductance and exchanging operations, as appeared in Fig. 1. Then again, the dc-transport capacitor is massive and overwhelming as well as one of the minimum dependable parts on different power electronic topologies.

Besides, the parasitic lead inductance can cause voltage spikes, which are a main consideration in the disappointment of energy electronic gadgets.

A disappointment review of switch mode control supplies revealed that electrolytic capacitors are in charge of the greater part of the breakdowns of an inverter. In this manner, there is expanding

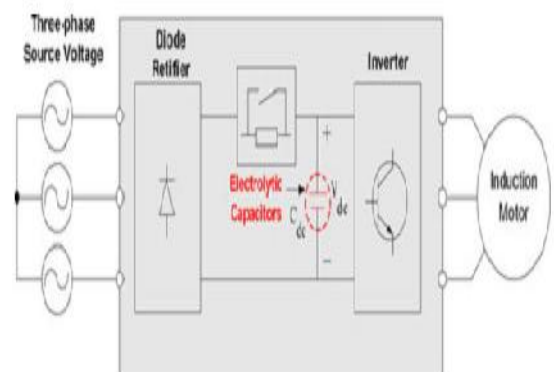


Fig. 1 Three-phase diode rectifier and PWM inverter for IM drive.

Enthusiasm for the checking lifetime of electrolytic capacitors for solid and safe operation. Then again, disconnected checking procedures require extra Measurements and in addition from the earlier information for the reference show, which makes observing procedure entangled and troublesome. A formerly revealed online technique for assessing the capacitance can't be connected to inverters nourished by diode rectifiers.

In such manner, a scope of regenerative converters and control techniques have been proposed with a specific end

goal to limit or decrease these detached Components on a dc transport. The concentration of most examinations has been on the most proficient method to diminish the dc-transport capacitor of three-stage beat width adjustment (PWM) rectifiers and single-stage diode rectifiers .

All past examinations were outfitted with a customary shut circle current controller to direct the air-hole torque and flux linkage of air conditioning engines. In any case, prompt current control in a little dc-transport capacitor inverter with the diode rectifier front-end is not direct in light of the fact that the dc-connect voltage and yield energy to the engine diminish intermittently because of the nonattendance of vitality stockpiling.

This quick dc voltage lessening drives the engine to be worked as often as possible in the field-debilitating district beneath a based speed. Thusly, the present control system turns out to be more confounded under voltage-restricted conditions in light of the fact that numerous target sub controllers, for example, field-debilitating, hostile to windup control, and over balance conspire, ought to be outlined deliberately in light of the mind boggling tradeoff between the sub control activities and current control elements .

Moreover, acknowledgment of the most extreme voltage usage comes up short on the grounds that a round voltage restrain is viewed as an operation limit rather than a hexagonal cutoff. This venture introduces a position sensor less vector-controlled acceptance engine (IM) drive framework coordinated into HVAC applications. The engine control is provided by a little dc-interface film capacitor inverter sustained by a three-stage diode front-end rectifier. A PI engine current-controller free control methodology is proposed to address the previously mentioned difficulties by joining.

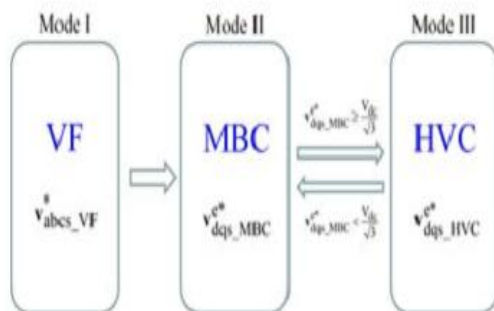


Fig.2 Proposed IM control strategy for small capacitor inverters.

A model-based controller (MBC) and a hexagon voltage controlling controller (HVC). The MBC finds the charge yield voltage with the crossing point of the torque and rotor flux linkage order. In the HVC mode, the summon voltage vector can be resolved essentially by the torque charge and the hexagon voltage limit. The MBC is performed under non constrained conditions and engine control is given consequently finished to the proposed HVC in the voltage deficiency district.

These voltage determination rules take into consideration the decision of a target voltage vector without PI control picks up, sub controllers, and eyewitnesses for shut circle control. The control system was executed on a 1.5-kW IM drive that was outfitted with a 20- μ F film capacitor to affirm its attainability.

II.Design and Analysis of a Motor Controller

Fig. 2 demonstrates a piece graph of the proposed control technique for an IM utilizing an intricate vector portrayal. Here, v^*_{abc} and v^*_{mdqs} are the stator voltage summons in the abc-reference outline and the synchronous reference outline, separately, and V_{dc} means

the deliberate dc-connect voltage. When beginning (Mode I), the scalar Volts/Hz or V/f open-circle control is acquainted with keep away from the absence of perceptibility of the engine back-EMF voltage at low speeds. This element allows the drive framework to fulfill the beginning pace prerequisite of the back-EMF following based position sensor less operation, of which the edge starts in the region of 10% of the evaluated speed. The control specialist is then given over to demonstrate based control (MBC, Mode II) or hexagon voltage controlling (HVC, Mode III), depending on the amount of available dc-link voltage.

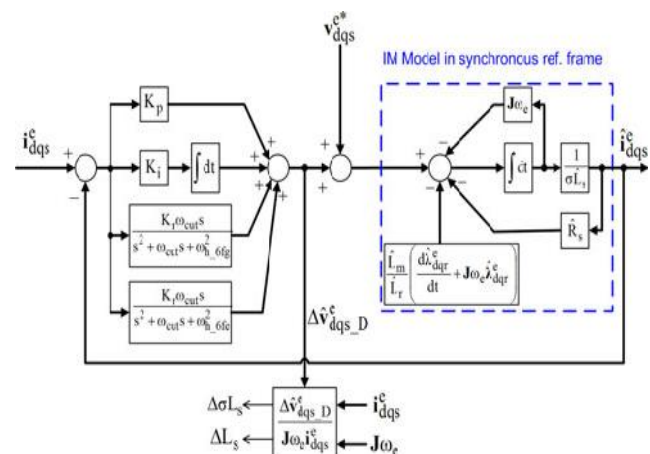


Fig. 3. State-filter design for decoupling the parameter dependence.

Compensation of effects parameters and state filter were explained in reference[1].

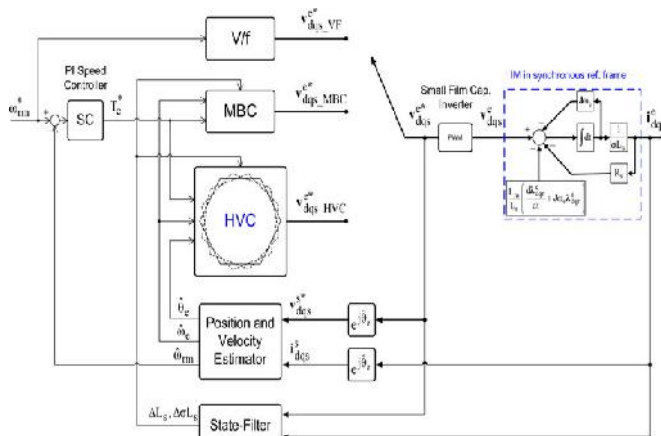


Fig. 4. Overall control block diagram.

III.FUZZY LOGIC CONTROL

FLC determined by the set of linguistic rules. The mathematical modeling is not required in fuzzy controller due to the conversion of numerical variable into linguistic variables. FLC consists of three part: a. Fuzzification, b. Interference engine, c. Defuzzification. The fuzzy controller is characterized as; For each input and output there are seven fuzzy sets. For simplicity a membership functions is Triangular. Fuzzification is using continuous universe of discourse. Implication is using Mamdani's "min" operator. Defuzzification is using the "height" method. FLC block diagram as shown in figure 2.

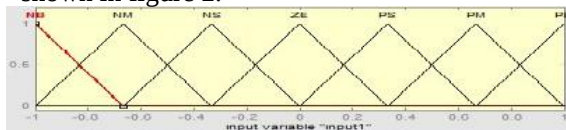


Fig. 5. Fuzzy Logic Controller

a. Fuzzification

Membership function values are assigned to the

linguistic variables, using seven fuzzy subsets: NB(Negative Big), NM(Negative Medium), NS (Negative Small), ZE (Zero), PS (Positive Small),PM(Positive Medium) and PB (Positive Big). The partition of fuzzy subsets and the shape of membership function adapt the shape up to appropriate system. Input error $E(k)$ and change in error $CE(k)$ of values which is normalized by an input scaling factor as shown in table 1.

ΔE_{in}	NB	NM	NS	ZE	PS	PM	PB
NB	NB	NB	NB	NB	NM	NS	ZE
NM	NB	NB	NB	NM	NS	ZE	PS
NS	NB	NB	NB	NS	ZE	PS	PM
ZE	NB	NM	NS	ZE	PS	PM	PB
PS	NM	NS	ZE	PS	PM	PB	PB
PM	NS	ZE	PS	PM	PB	PB	PB
PB	ZE	PS	PM	PB	PB	PB	PB

Table1:Fuzzy Rules

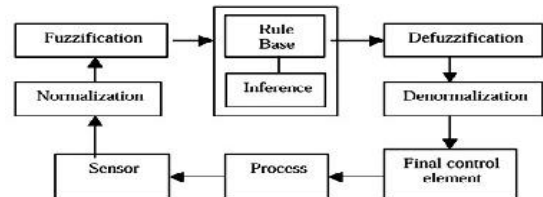


Fig.6 Input1 Membership function

In this system the input scaling factor is between -1 and +1 has design. The triangular shape of the membership function of this arrangement presumes that for any particular input there is only one dominant fuzzy subset . The input error $E(k)$ and change in error $C(k)$ for the FLC is given as

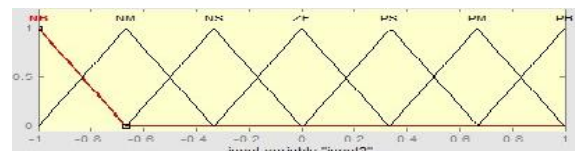
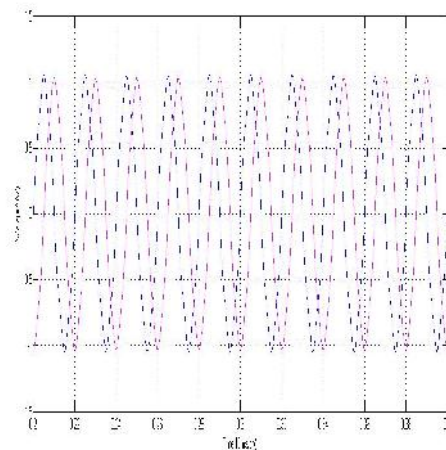
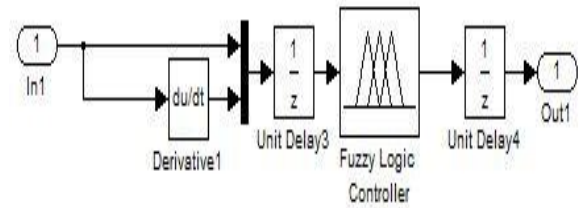


Fig.7 Input2 Membership function

IV.MATLAB DESIGN AND SIMULINK RESULTS



This project addresses the controller design of a position sensor less vector-controlled IM drive system supplied from a small dc-link film capacitor inverter fed by a three-phase diode frontend rectifier. The proposed approach focuses on the controller performance when entering or leaving the infeasible voltage domain. The PI

motor-current-regulator-free control structure presents a smooth transition from the MBC under the unconstrained voltage region to the HVC when the voltage limit is encountered. The analytical solution leads to the dynamic voltage modification at each time step with respect to the available dc-bus voltage.

The algorithm can provide adequate results over a number of potential secondary upsets found in the current regulator-based control structure. The operation sensitivity under motor parameter drifts is also examined to decouple its influence using a voltage disturbance state filter. The test results clearly show that the proposed method can improve the inverter reliability without sacrificing the motor control performance.

This project improves the output voltage and smoothening wave forms by using fuzzy controller than PI controller. Simulation results verified through MATLAB/SIMULINK environment.

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