Synchronous reference frame method for multiple bidirectional converters in a DC/AC micro grid

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Abstract— Various bidirectional converters are used in a DC/AC miniaturized scale lattice system which should be synchronized to the three stage voltages of the matrix. The VSI with six changes should be controlled by Synchronous reference outline technique decreasing the THD in AC side and swell in the DC side. The utilization of this technique likewise diminishes the flowing current in the converters thus lessening exchanging misfortunes in the converters. At that point, the enhanced control technique for bidirectional converters in half breed microgrid worked in island mode is exhibited to lessen flowing current and power-sharing deviation, which incorporates the hang controller used to accomplish programmed power sharing and the enhanced virtual impedance controller used to additionally diminish coursing current and power-sharing deviation. Finally, reenactment and trial comes about verified that the proposed control technique can all the while accomplish coursing current lessening and programmed power sharing, and does not diminish the yield power ability of converter. The proposed control technique is reasonable for the configuration that has a specific transport between bidirectional power converters, and the air conditioner transport associated with air conditioning loads and the host lattice. The outline and investigation of the bidirectional converters and network execution for the SRF strategy are seen in MATLAB programming with THD FFT (Fast Fourier Transformation) examination.

I. INTRODUCTION

In recent years, improvement of complex static change procedures has increased expanding consideration from numerous scientists in light of the developing interest for mechanical engine drives with power molding and power factor administration. Numerous current power converter and engine drives system draw the non– sinusoidal information current from the mains. The traditional AC/DC amendment approach of utilizing a full wave connect took after by a mass capacitor isn't appropriate because of the bothersome information current music [1-4]. These music should be controlled utilizing aloof sifting or dynamic separating with power factor remedy. A typical issue related in drive system with visit recovery is the measure of the dc interface capacitor is regularly extensive to confine the connection voltage. Typically, an expansive capacitor bank of thousands of microfarad is required. The substantial estimation of capacitor not just builds the size and weight of converter hardware, yet in addition gear cost. So as to lessen the connection capacitor, a bi-directional converter can be utilized with the goal that regenerative energy can be fed to the supply as opposed to being put away in huge capacitor. This undertaking presents an adjusted thyristor based AC/DC power converter circuit with lessened sounds and enhanced power factor. The in ductor normal current control technique for the converter gives enhanced power factor in both power stream course. The info current is sinusoid partner formed to take after the information voltage either in stage with the info voltage in motoring mode or 180 degree out of stage with the information voltage in the recovering mode. Along these lines, the power factor approaches solidarity decreases sounds and unsettling influence on the power supply. The outline and execution of the converters is approved through the PC recreation utilizing MATLAB SIMULINK. The plan and execution examination of the proposed converters are approved through the PC reenactment utilizing MATLAB/SIMULINK.

The coursing current lessening strategy for parallel converters is broadly examined by scientists. The disengagement transformer is utilized for removing the zero-succession current circuit in [11], which can viably dispense with the circling current. Hence, the system will wind up massive and expensive. The definition and control strategies for flowing current are introduced in [13] and [14], which considered the case that diverse converters with or without break even with limits are paralleled. In any case, the control accuracy of this strategy is delicate to the parameters of associating inductor and yield line, and the plan procedure of this technique is confounded.

References [15]– [17] have proposed the zero-grouping coursing current decrease technique, which can adequately lessen the zero-arrangement flowing current by directing the zero voltage space-vector, and whose physical significance is clear. The control techniques exhibited in [15]–[17] did not consider the disposal of nonzero-arrangement part in coursing current. Multicarrier beat width modulator is displayed for parallel converters, in which the capacity of the zero voltage space-vector is supplanted by multicarrier beat width modulator to diminish circling current. The multicarrier beat width modulator successfully diminished the exchanging loss of Insulated Gate Bipolar Transistor, however this technique is just material to parallel activity of two converters with basic dc transport. Besides, the yield power of converters ought to be consequently in extent to the power rating of converters so as not to harm any individual converter. At display, power-sharing control techniques for parallel converters examined in references fundamentally have normal current-sharing control, master– slave control, and hang control. Among them, the normal current-sharing control strategy and master– slave control examined has a place with the unified control, and they have quick reaction speed and exact current-sharing impact.

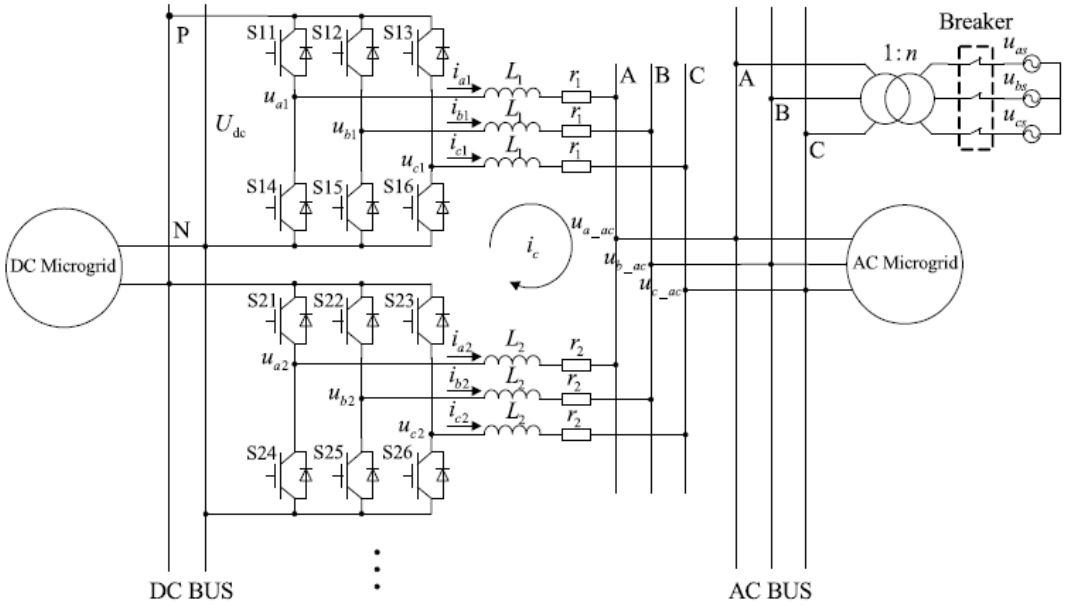

Fig. 1: Proposed multiple parallel bidirectional converters

II. WORKING PRINCIPLE OF CONVERTERS

Typically, the plentifulness and recurrence of the air conditioner transport voltage are controlled by bidirectional power converters, and the dc transport voltage is managed by the dc/dc converter associated with energy stockpiling gadget when the half breed air conditioning/dc microgrid working in island mode. The half breed air conditioning/dc microgrid with different parallel bidirectional power converters is appeared in Fig. 1.

In Fig. 1, Udc is the dc transport voltage; ua_ac, ubs_ac, and ucs_ac are the three-stage voltages of air conditioning transport; uas, ubs, and ucs are the three-stage voltages of the host framework; iaj, ibj, and icj (j =1, 2,...) are the yield currents of the jth converter; and uaj, ubj, and ucj(j = 1, 2,...) are the yield stage voltages of the jth converter. In Fig. 1, it can be seen that circling current and power-sharing deviation will be produced because of the offbeat exchanging tasks of the exchanging gadgets in a similar stage connect arm of various converters. Keeping in mind the end goal to helpfully dissect the coursing current among parallel bidirectional power converters, one can consider the case of three single-stage converter parallel systems, as appeared in Fig. 2. In Fig. 2, io is the aggregate yield current of numerous bidirectional power converters; ixj(x = a, b, c; j = 1, 2, 3,...) means the x-stage yield current of the jth bidirectional power converter; and ixjm(x = a, b, c; j = 1, 2, 3,..., m =1, 2, 3,..., n) signifies the x-stage flowing current between the jth and mth converter. As indicated by Fig. 2, io can be communicated as (1) when n is three

io = ix1 + ix2 + ix3

= (ix1 − ix12 − ix13) + (ix2 + ix12 − ix23)

+ (ix3 + ix13 + ix23).

Assume that the x-stage coursing current of the jth converter is Cxj, and the reference bearing of each stage circling current of different converters is flow from dc side to air conditioning side in half and half air conditioning/dc microgrid. As per Fig. 2, one can get

io = (ix1 − cx1) + (ix2 − cx2) + (ix3 − cx3).

Since the power rating of bidirectional power converters are typically indistinguishable in mixture air conditioning/dc microgrid, the yield current of any perfect power converter ought to be io/n when the aggregate yield current of n converters I s io. In the interim, in the numerous converters parallel system, the controller for sharing current and disposing of coursing current has a similar target that the controlled factors ought to be managed near zero, and the current-sharing deviation and flowing current are as one defined as target current (ihx, x = a, b, c)for the comfort of recognizing.

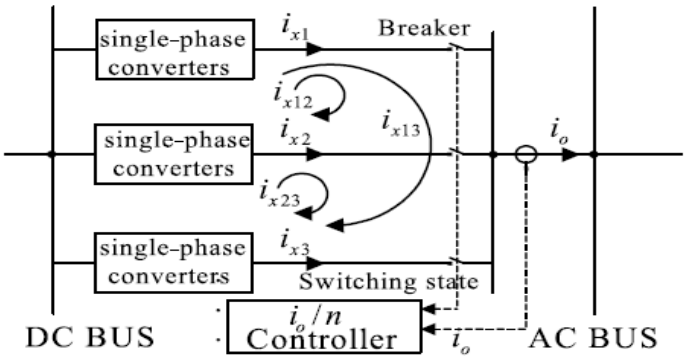

Fig. 2: Circulating currents generation in parallel converters

III. SRF CONTROL OF CONVERTER

Synchronous Reference Frame strategy (SRF) is a standout amongst the most well-known and presumably it is the best technique. It depends on the way that music changes their recurrence in a pivoting reference casing, thus they are better disengaged with high pass channels. The strategy presents superb attributes yet it is somewhat hard to execute. This paper introduces an alternate alteration in light of a similar rule and contrasts its exhibitions and sinusoidal source and adjusted load condition. The Modified SRF strategy called, in this paper, Filtered Modified Reference Frame Method (FMRF), in light of the fact that it utilizes channels and depends on the altered reference outline technique [8]. Among the few strategies exhibited in the writing, the Synchronous Reference Frame technique (SRF) is a standout amongst the most well-known and presumably it is broadly utilized strategy. This segment is sorted out as to depict briefly the SRF techniques. The three techniques displayed in this segment with a few outcomes got with the previously mentioned strategies. The nonlinear load considered is a three-stage diode connect rectifier. In the SRF [5], the load current signs are changed into the traditional turning outline d-q.

Fig.2 demonstrates the fundamental arrangement of synchronous reference outline. In the SRF is a period changing edge that speaks to the precise position of the reference outline which is turning at steady speed in synchronism with the three stage air conditioning voltages. In the SRF ◆ is a period changing edge that speaks to the precise position of the reference outline which is pivoting at steady speed in synchronism with the three stage air conditioning voltages. To actualize the SRF technique some sort of synchronizing system ought to be utilized. In [6] stage bolted circle (PLL) is utilized for the usage of this strategy. For this situation the speed of the reference outline is for all intents and purposes consistent, that is, the strategy acts as though the reference casing's snapshot of latency is boundless. The essential currents of the d-q parts are presently dc esteems. The sounds seem like swell. Symphonious disconnection of the d-q changed flag is accomplished by expelling the dc counterbalance. This is proficient utilizing high pass channels (HPF). Regardless of a high pass channel, a low pass channel is utilized to get the reference source current in d-q organizes.

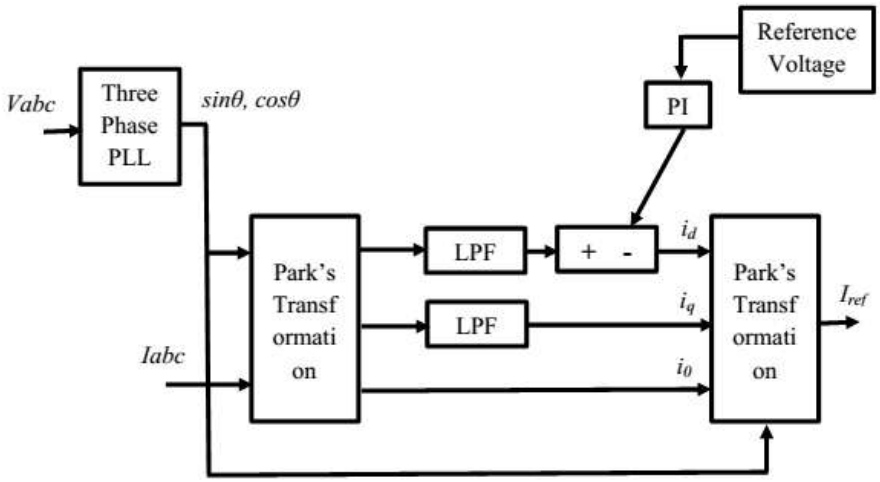

Fig. 3: SRF control structure for bidirectional converter

IV. SIMULATION RESULTS

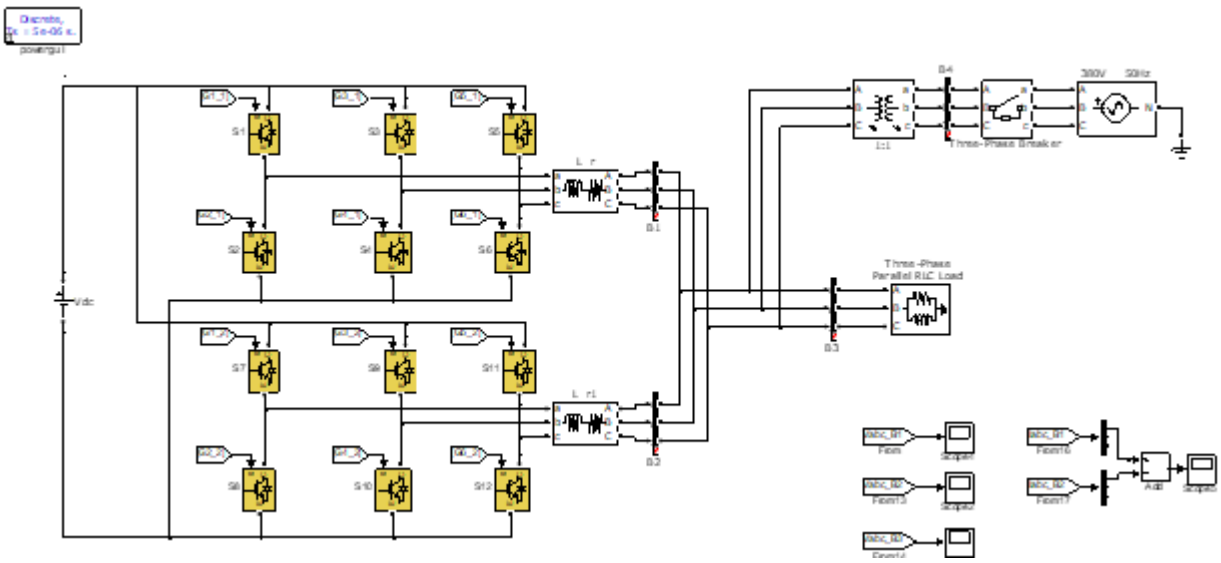

Fig. 4: Simulink modeling of proposed converter system

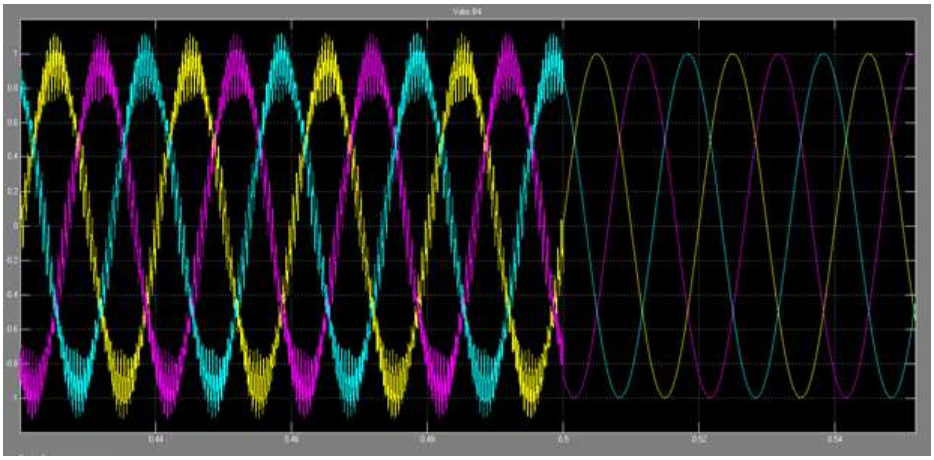

Fig. 5: Voltage at Bus 4 before and after control added

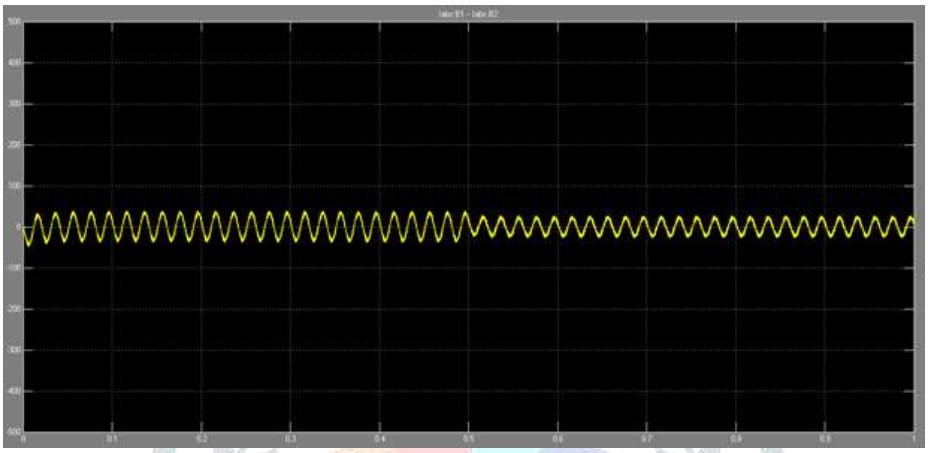

Fig. 6: Reduction in current comparison with SRF controller

V. CONCLUSION

In this paper, an enhanced control strategy with coursing current lessening and precise power sharing are displayed for the bidirectional power converters in cross breed air conditioning/dc microgrid worked in island mode, and the proposed control technique has been contrasted and the ordinary virtual impedance control technique in the exhibitions, for example, flowing current decrease, power sharing, and the yield power of converter. Different reenactment and trial comes about have verified that the proposed control technique has more exact power sharing and viable coursing current diminishment than the customary virtual impedance control strategy and does not restrain the power yield ability of power converters. Besides, the proposed control strategy has such attributes as straightforward structure, simple to computerized control, and great autonomy. Note that the proposed control technique is appropriate for the configuration appeared in Fig. 1, which has a specific transport that is utilized to interface the bidirectional power converters to the air conditioner transport associated with air conditioning loads and the host framework.

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