

Fig. 13. Approximation of the function  $f(x)=\sin(x)$  in the interval  $< 0, 2\pi )$  by use of the stepped wave form  $f_{N=6}(\alpha = 2\pi/9, \theta = 0.4)$ : a)  $f_{N=6}$ , b) spectrum.

#### 4. Cascaded 3-level inverter with reduced THD

A schematic diagram of a cascaded inverter has been presented in Fig. 14. In such a kind of the 3-level cascaded VSI the summing block is not needed because output voltages of constituent inverters are connected in series. So, the final output voltage is created as a result of a sum or a difference of two voltage values.

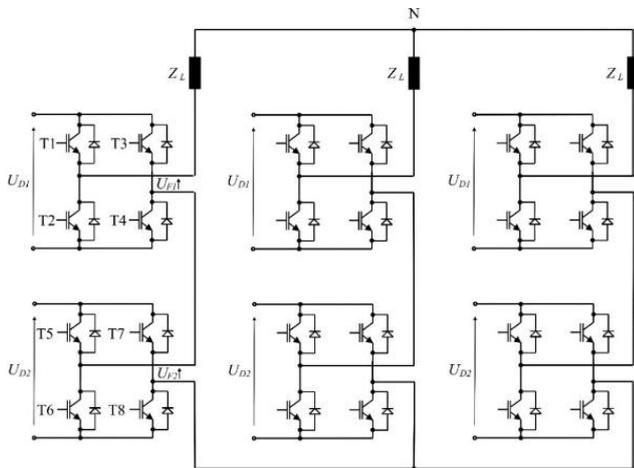


Fig. 14. Cascaded three phase 3-level inverter.

Applying a very simple rule of control it is possible to obtain three-phase 3-level voltage wave form supplying the output load. For illustration the switching sequence:  $T1-T4, T1-T4 \cap T5-T8, T1-T4, T2-T3, T2-T3 \cap T6-T7, T2-T3$  presented in Chapter I assures 3-level wave forms. It is evident that successive phase control signals are adequately shifted. According to results of wave form optimization a very good approximation is possible to realize if angle range and supply voltages have to satisfy parameters:  $\alpha = 40^\circ, \theta = 0.4, V_0 = 0.3655, V_1 = 0.9136$ . Resulting in supply voltages  $U_{D1}$  and  $U_{D2}$  have to be calculated to reach an assumed value of the fundamental harmonic. For instance the inverter supplied by  $U_{D1} = 110\text{ V}$  and  $U_{D2} = 165\text{ V}$  generates stepped wave forms  $f_{N=6}$  that the fundamental harmonic  $b_1 = 300\text{ V}$  and  $THD = 20,98\%$ .

#### 5. Conclusion

According to assumed criterion of minimal THD the best 3-level stepped voltage can be realized if both parts of a standard 3-level NPC inverter or both H inverters in cascaded topology are supplied by two different DC voltages. Research results presented in the paper prove that in order to obtain minimal THD factor of the output voltage it is necessary to use precisely calculated parameters of DC voltage supplying the inverter units. Next requirement relates to parameters of the stepped wave form  $f_{N=}$ . It seems that such a solution is easier to develop in cascaded inverters than in 3-level ones. Optimal parameters of the output voltage:  $\alpha = 36^\circ (\pi/5), \theta = 0,35$  guarantee the minimal value of the THD factor. Theoretically the same result could be achieved in standard NPC 3-level inverters but it would be necessary to divide intermediary DC voltage according to optimal parameters as well as to maintain this state during active work of the inverter.

#### References

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