INFLUENCE OF LOADING ON ACCURACY OF CALCULATIONS OF THE ELECTRIC CIRCUIT DURING THE MOMENT SHORT CIRCUIT

R. Z. Kazimzadeh

The Azerbaijan State Oil Academy,
Baku, Azerbaijan

ABSTRACT

The technique of influence of consumer loading on currents of short circuit is considered. Some features of influence of connection, i.e. consecutive and parallel inclusion, and also character of loading (inductive or active) are revealed. Dependence of size of these loadings on parameters of a circuit (section of cables, length of a line, specific resistance, magnetic permeability, etc.) is given.

Keywords: influence, resistance, magnetic, generator, transformer.

I. INTRODUCTION

Consumer loading of the generator before approach of short circuit is usually taken into account by excitation of the generator. In the elementary circuits consumer loading settles down behind of a place of short circuit, i.e. will not be energized and will not consume currents from the generator, and the current of the generator in this case is equal to a current of short circuit. If consumer loading is attached in parallel to a site of short circuit under action of a residual voltage it will eat a current from the generator, but in the reduced size. Therefore from generator will be consumed more currents of short circuit on size of these consumer currents of short circuit. The established current of short circuit can arise in a network in which the zero point of the generator or the transformer and this current earthed is a current. And all this technique can be used for networks as with active and jet resistance. At prevalence of only inductive jet resistance of loading the total power failure of dispersion and a voltage from reaction of an anchor will be strictly proportional to a loading current

$$\Delta U = I\left(x_{L1} + x_{L2}\right)$$

II. MAIN PART

Where I - an average current; X_{L1} – resistance of reaction of an anchor; X_{L2} – resistance of dispersion; X_{L1} and X_{L2} – resistance of inductive character.

Taking into account, that inductance in a circuit depends on such components as length of a line and radius of section of a line jet inductive resistance will develop from

$$x_L = x_{L1} + x_{L2}$$

where

$$L_1 = 2\ell \ln \frac{1{,}85}{r\sqrt{4\pi\omega\gamma \cdot 10^{-7}}} 10^{-7}$$

γ - Specific conductivity of air, Ом.м; r – radius of a line.

$$L_2 = d\ell e^{-\frac{\gamma\ell}{2}}$$

or

$$L_2 = \frac{\ell}{4\pi r}\sqrt{\frac{\rho\mu}{\pi f}}$$

The general jet inductive resistance at parallel connection will develop of inductive resistance of a network X_{L1} and consumer X_{L2}, i.e.

$$x_L = \frac{x_{L1} x_{L2}}{x_{L1} + x_{L2}}$$

which now becomes resistance of a network.

In this case the current in a network will be a current of the generator

$$I = \frac{U}{\sqrt{3}\left(x_{L1} + x_{L2} + x\right)}$$

for three-polar short circuit so will be

$$I=\frac{U}{\sqrt{3}\left[(x_{L1}+x_{L2})\frac{x_{L1}+x_{L2}}{x}+x_L\right]}=$$

$$=\frac{U}{\sqrt{3}\left[x_{L1}\left(1+\frac{x_{L1}}{x_{L2}}\right)+x_S\left(1+\frac{x_{L1}}{x_{L2}}\right)+x_L\right]}$$

In a limiting case at $X_1 \to \infty$ come back to the data before to ratio, whereas at $X_1 \to 0$ the established current of short circuit and it disappears and through the generator the part of the three-polar established current of short circuit proceeds only.

The made conclusions can be applied and for bipolar short circuit if, certainly, consumer loading consumes a bipolar current from the generator. In this case the bipolar current with bipolar consumer loading will be

$$I=\frac{Ux_{L1}}{x+2(x_{L1}+x_{L2})(x_L+x)}=$$

$$=\frac{U}{x_{L1}\left(1+\frac{x_{L1}}{x_{L2}}\right)+2x_{L2}\left(1+\frac{x_{L1}}{x_{L2}}\right)+2x}$$

calculation in this case gives

$$I=\frac{U}{x\left(1+\frac{x_{L1}+x_{L2}}{x_{L1}+x_{L2}+x_L}\right)+2(x_{L2}+x_L)}=$$

$$=\frac{U}{x_{L1}+2x_{L2}}$$

at $x_1 \to \infty$ the same settlement formulas turn out. If consumer loading is attacted in parallel a site of short circuit the bipolar established current will be

$$I=\frac{U}{x_L\left(1+\frac{x_L}{x_{L1}+x_L}2\frac{x_{L1}}{x_L}\right)+2x_{L2}\left(1+\frac{x_L}{x_{L2}}\right)+2x_L}=$$

$$=\frac{U}{x_L+2x_{L2}}\bullet\frac{1}{1+\frac{x_L}{x_{L1}}}$$

If consumer loading is located behind of a place of short circuit it is not energized and will not consume a current.

By consideration of networks with significant ohmic resistance the power failure will be

$$U=I\sqrt{R^2+X_L^2}$$

where resistance R is determined as

$$R=\frac{l}{\pi D}\sqrt{\frac{\omega\rho\mu}{2}}$$

$$R=\frac{l}{\pi D}\sqrt{\frac{\omega k I_0 \rho}{2\pi D}}e^{-\frac{\gamma l}{2}}$$

so depends on magnetic permeability of a material, and specific resistance of a material.

Hence, at definition of full resistance it is necessary to take into account all specified parameters, both for ohmic, and for inductive resistance. On the vectors of an inductive power failure and dispersion the generator are directed perpendicularly to an ohmic power failure of a current of short circuit (fig.1).

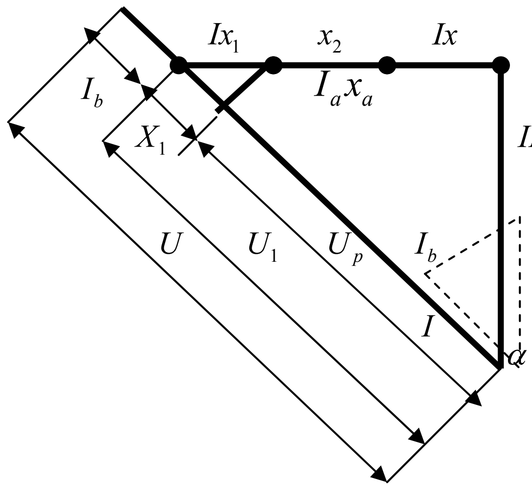

Fig. 1. The vector diagram of the synchronous machine at short circuit on resistance of sites

$$U=I\sqrt{R^2+(x_{L1}+x_{L2})^2}$$

III.CONCLUSIONS

Influence consumer loadings on a current in a circuit are taken into account by excitation of the generator, and the current of the generator is equal to a current of short circuit. But in case of parallel connection to a site of short circuit consumer loading will eat a current from the generator, but in the reduced size. Thus influence in these connection parameters both jet and active loadings are offered. It is established, that at falling inductive loading established the current will be a current of short circuit, both for bipolar, and for three-polar loading. In the investigated circuits all parameters depend on specific resistance and magnetic permeability.

REFERENCES

1.*Kazimzadeh R.Z.*The theory of electric circuit. ASOA, Baku, 2004.(in Russian)

2. *Kazimzadeh R.Z.* The theoretical electrical engineering. ASOA, Baku, 2003(in Russian)

3. *Kazimzadeh R.Z.* Short circuit on lines and their influence on attenuation of signals in liaison channels. News of the maximum technical educational institutions of Azerbaijan. Baku, 2002, № 1(17) (in Russian).

4. *Kazimzadeh R.Z.* Non-uniform of loading in asymmetrical three-phase circuits and definition of their active and jet parameters. Inf. the maximum technical educational institutions of Azerbaijan. Baku, 2005, № 2(36). (in Russian)

5. *F.Ollendof.* Calculation of the established current of short circuit of simple networks (translation from German) DVOU, Kharkov-Odesa, 1931. (in Russian)

6. *Kazimzadeh R.Z.* The theory of the underground liaison channels used in oil industry. «Lenin-Sofia», 1970. (in Russian)