GROUND FAULT CURRENT IN COMPENSATED MV GRIDS

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ABSTRACT

In the introduction part a problem of ground fault current is introduced. It shows its effect on distribution grids.The second part tries to analyze the current stage of distribution grids and tries to explain some basic facts about residual ground fault current in distribution grids and what it affects.The last part introduces one solution of this problem developed in Sweden in 1992.

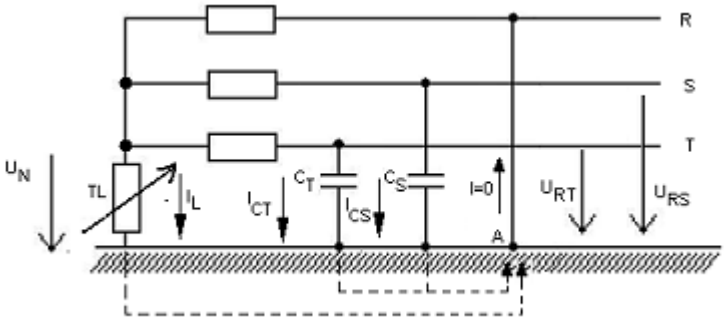
1. INTRODUCTION

Ground fault is one of the most frequent faults in almost all transmission and distribution grids. Ground fault currents are pretty low (a lot lower than short-circuit currents), therefore their force and thermal effects do not endanger other appliances of the distribution grid. However, with large distribution grids the ground fault current can be even higher than 5A and danger of electric arc ignition arises. Electric arc represents danger for distribution grid isolation, risk of wire line remelting and danger of damaging another linewires. What´s more, during the process of arc extinguishing an overvoltage arises in distribution grids. Its value can be 4.5 times higher than a nominal value of the transmission grid. This is another danger for wire line isolation. This can be prevented by compensating of residual ground fault current.

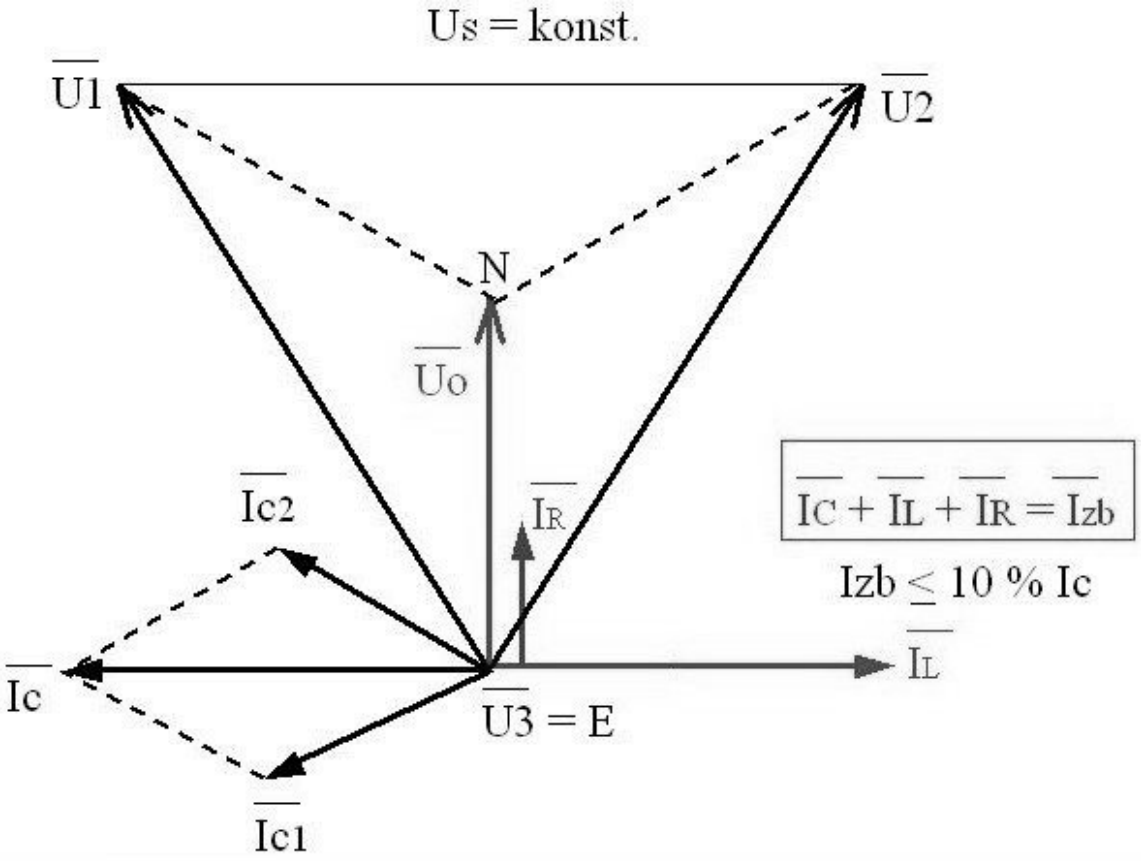
2. ANALYSIS

As the time flows, there has been an increasing demand for a reliable and uninterrupted power supply. Therefore the overhead lines are being replaced by cable grids. This solution has its pros and cons. The biggest advantage is that the number of weather conditions related disturbances has been reduced. Disadvantages of this solution is in localization and repairing of cable faults, which takes a lot more time. Another problem is in cost of cable grids. Last but not least, it is impossible to operate faulty cable grid and ground fault very often develops in short circuit. The danger of electric arc ignition with all its effects has already been mentioned above. This case usually leads to power supply interruption for local area.

To reduce the capacitive residual ground fault current in semi-direct grounded grid a Petterson coil has been used [1].



Picture 1: Semi-direct grounded grid [3]



Picture 2: Phasor diagram [3]

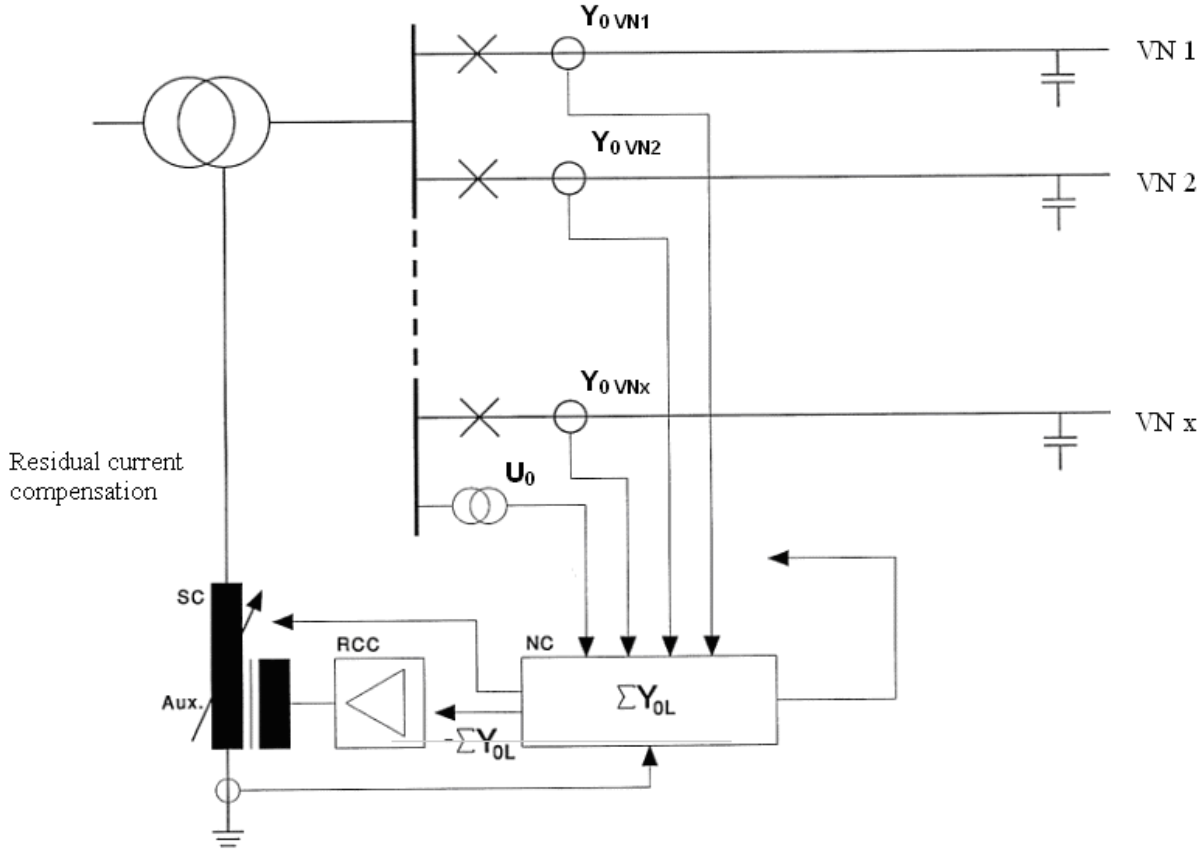
In an ideal case, there is no residual ground current in the grid. In real, there always is some and the point of this solution is to make it as low as possible.

3. SWEDISH NEUTRAL

The increasing number of cable grids has side effects on overhead lines. The capacitive ground fault current is approximately 30 times higher in cable grids than in overhead lines.

The remaining residual ground fault current is higher as well. Therefore in Sweden there was initialized a development of a modern ground fault neutralizer, which would be able to fully compensate the capacitive residual ground fault current in MV distribution grids.

It was called Swedish Neutral. The first usage of Swedish Neutral was in 1992 on Swedish island Gotland [4]. Since then, it has spread through Europe and one instalation of Swedish Neutral is in Czech Republic as well.



Picture 3: Scheme of Swedish Neutral [4]

This solution not only enables to fully compensate the capacitive residual current. It also enables fast and effective electric arc extinguishing and then localization of the place with ground fault connection. Ground fault still exists in the distribution grid, but there is no remaining residual current. Swedish Neutral enables to operate cable grid with ground fault connection.

4. CONCLUSION

Together with development there has been an increasing demand for reliable power supply. Thanks to the technic progress we have means to meet this demand. One of the possible solutions, developed in Sweden, was introtuced in this paper.

REFERENCES

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[4] Web pages of company Swedish Neutral: http://www.schwedishneutral.se/