e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
April 2018

ADVANCED GENERATOR GROUND FAULT PROTECTIONS IN PULP AND PAPER MILL APPLICATIONS

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ABSTRACT

Ground faults in generator stator and field/rotor circuits are serious events that can lead to damage, costly repair, extended outage and loss of revenue. This paper explores advances in field/rotor circuit ground fault and stator ground fault protection. These advanced protection strategies employ AC injection, ground differential protection and the use of hybrid grounding to reduce both internal generator ground fault levels and facility ground levels in utility-paralleled operating modes.

INTRODUCTION

Traditional field/rotor circuit ground fault protection schemes employ DC voltage detection. Schemes based on DC principles are subject to security issues during field forcing and other sudden shifts in field current. To mitigate the security issues of traditional DC-based rotor ground fault protection schemes, AC injection-based protection may be used. AC injection-based protection ignores the effects of sudden DC current changes in the field/rotor circuits and resulting DC scheme security issues. Direct (bus) connected generators are often applied in pulp and paper mill facilities. The bus connection is made at the medium voltage level, typically at the 5kV and 15kV level. These generators are typically low impedance-grounded. The traditional stator ground fault protection scheme is time-delayed ground over current (51G).

Current that rises through the neutral of the faulted generator will not be interrupted by tripping the generator breaker, and will persist for several seconds until the field demagnetizes. A considerable amount of burning damage will be done during this time if the generator neutral is low-resistance grounded. Therefore, solutions to this problem must involve several elements. The number and ratings of low-resistance grounding resistors on the system should be kept to a minimum. Techniques to accomplish this include designing the system around the concept of "zero-sequence islands" in which the

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
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number and rating of transformer ground sources within each island is strictly limited,

PROPOSED SYSTEM

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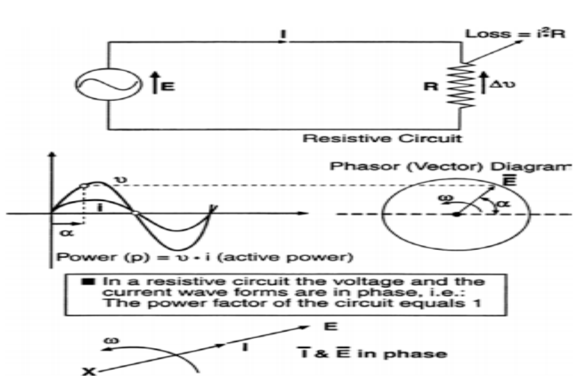
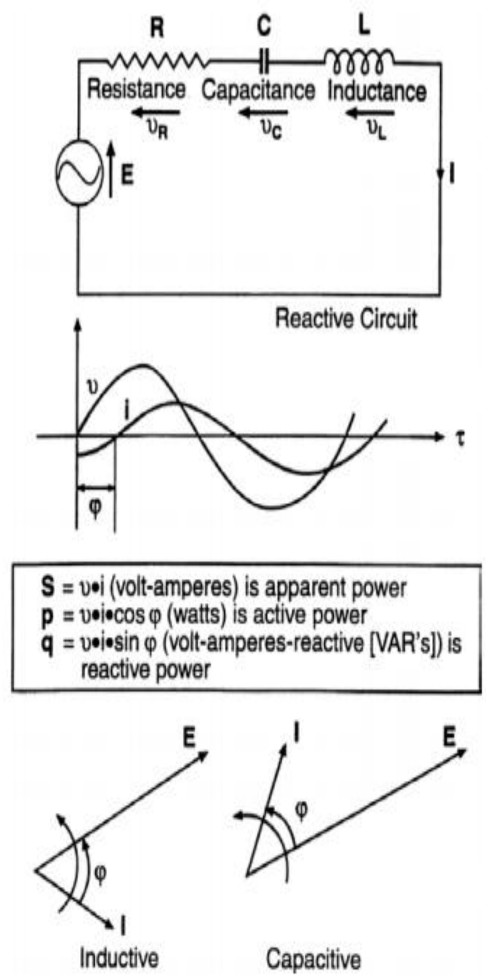


: Alternating circuits (resistive).

The active power P of a circuit indicates a real energy flow. This is power that may be dissipated on a resistance as heat, or may be transformed into mechanical energy, as it will be shown later. However, the use of the word "power" in the name of S and Q has been an unfortunate choice that has resulted in confounding



: Alternating circuits (resistive–Inductive–Capacitive).

e-ISSN: 2348-6848
p-ISSN: 2348-795X
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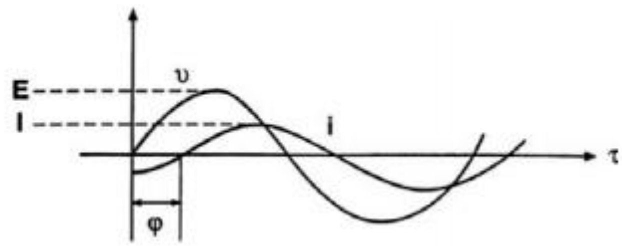
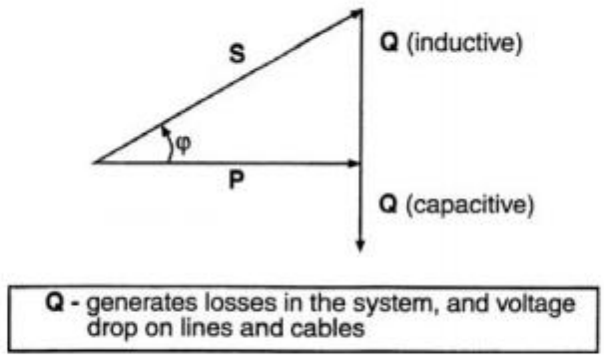
Here the sinusoidal voltage E is applied to a circuit comprised of resistive, capacitive, and inductive elements. The resulting angle between the current and the voltage depends on the value of the resistance, capacitance, and inductance of the load.

Most individuals without an electrical engineering background for many years. The fact is that apparent power and reactive power does not represent any measure of real energy. They do represent the reactive characteristic of a given load or circuit, and the resulting angle (power factor) between the current and voltage. This angle between voltage and current significantly affects the operation of an electric machine, as it will be discussed later. For the time being let us define another element of ac circuit analysis: the power triangle. From the relationships shown above among S, P, Q, E, I, and ϕ, it can be readily shown that S, P, and Q form a triangle. By convention, Q is shown as positive (above the horizontal), when the circuit is inductive, and vice versa when capacitive





THREE-PHASE CIRCUITS

The two-wire ac circuits shown above (called single-phase circuits or systems), are commonly used in residential, commercial, and low voltage—low power industrial applications. However, all electric power systems to which industrial generators are connected are three-phase systems.

Therefore any discussion in this book about the "power system" will refer to a three-phase system. Moreover in industrial applications the voltage supplies are, for all practical reasons, balanced, meaning all three-phase voltages are equal in magnitude and apart by 120 electrical degrees. In those rare events where the voltages are unbalanced, its implication into the operation of the generator will be discussed in other chapters of this book. Three-phase electric systems may have a fourth wire, called "neutral." The "neutral" wire of a three-phase system will conduct electricity if the source and/or the load are unbalanced.

CONCLUSION

The use of AC injection offers greater security than traditional DC systems, and also affords brush lift-off protection. Compared to low-impedance grounding, the use of hybrid grounding offers advantages for lowering facility ground fault levels and lowering internal generator short circuit ground fault levels. The key to employing hybrid grounding is the application of secure ground differential (87GD) protection.

REFERENCES:

1. Grounding and Ground Fault Protection of Multiple Generator Installations on Medium-Voltage Industrial and Commercial Power Systems. Prafulla Pillai, Bruce G. Bailey, Jim Bowen, Gerald Dalke, Bruce G. Douglas, Jay Fischer, James R. Jones, Daniel J. Love, Charles J. Mozina, Neil Nichols, Clifford Normand, Lorraine Padden, Alan Pierce, Louie J. Powell, David D. Shipp, Norman Terry Stringer, and Ralph H. Young