Ferroresonance is a nonlinear phenomenon which appears in the system that involves capacitors and non-linear inductances such as transformers. It generally results in overvoltages and/or overcurrent spikes that may lead apparatus insulators to dielectric and thermal stresses and hence breakdown and subjecting operators to hazardous conditions.

In this research work, three main investigations have been performed: For the first, ferroresonance favorable cases are analyzed showing; the effect of the grading capacitor, a transformer losing one phase, the magnetizing curve with fixed reluctance, the saturated part of the magnetizing curve and the transformer with ground fault. These scenarios are applied to a medium voltage network Haoud Berkaoui in the south of Algeria. The simulation is conducted using the Alternating Transient Program (ATP), the obtained results are encouraged to be used for studying this phenomenon.

In the second part, the Root Cause Analysis method is applied to ferroresonance study for the first time. Its objective is to find out the root cause of this phenomenon. A number, as large as possible, of events considering the well-known different causes may be gathered, and step by step, the final event which is ferroresonance is reached. Then, mitigation techniques are summarized in new events playing the role of barriers reducing the occurrence of ferroresonance. The computation of the probability of ferroresonance occurrence with and without barriers is investigated, the obtained results are satisfactory. The third part concerns the study of ferroresonance in islanded power grid with the absence of transformer. In fact, the only presence of the induction generator and the capacitor bank generally used for compensation purpose, may lead to ferroresonance. For the avoidance of this disturbance, a reconfiguration of distributed resources in islanded power grid is proposed. The resize of the capacitor bank is performed, a range of capacitor values is proposed