

VOLTAGE SAGS AND INTERRUPTIONS

2. Introduction

Voltage sags and interruptions are related power quality problems. Both are usually the result of faults in the power system and switching actions to isolate the faulted sections. They are characterized by rms voltage variations outside the normal operating range of voltages.

Voltage sag

A *voltage sag* is a short-duration (typically 0.5 to 30 cycles) reduction in rms voltage caused by faults on the power system and the starting of large loads, such as motors.

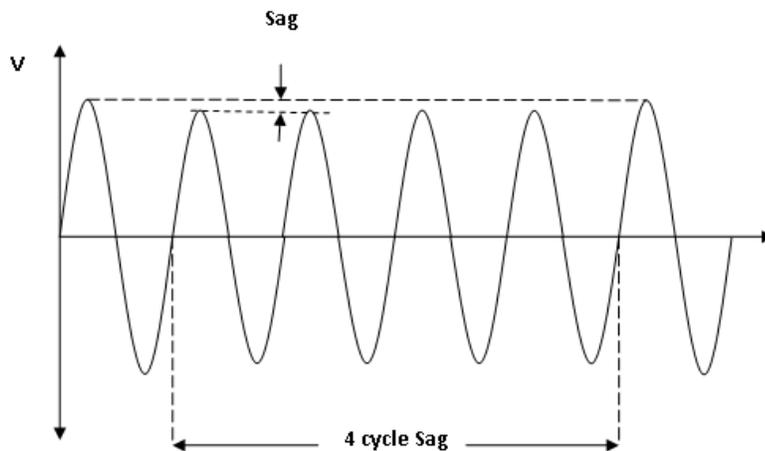


Figure 2.1 (a) Voltage Sag

Voltage swell

Voltage swell is an increase in RMS voltage at the power frequency for duration of 0.5 cycles to 300 cycles.

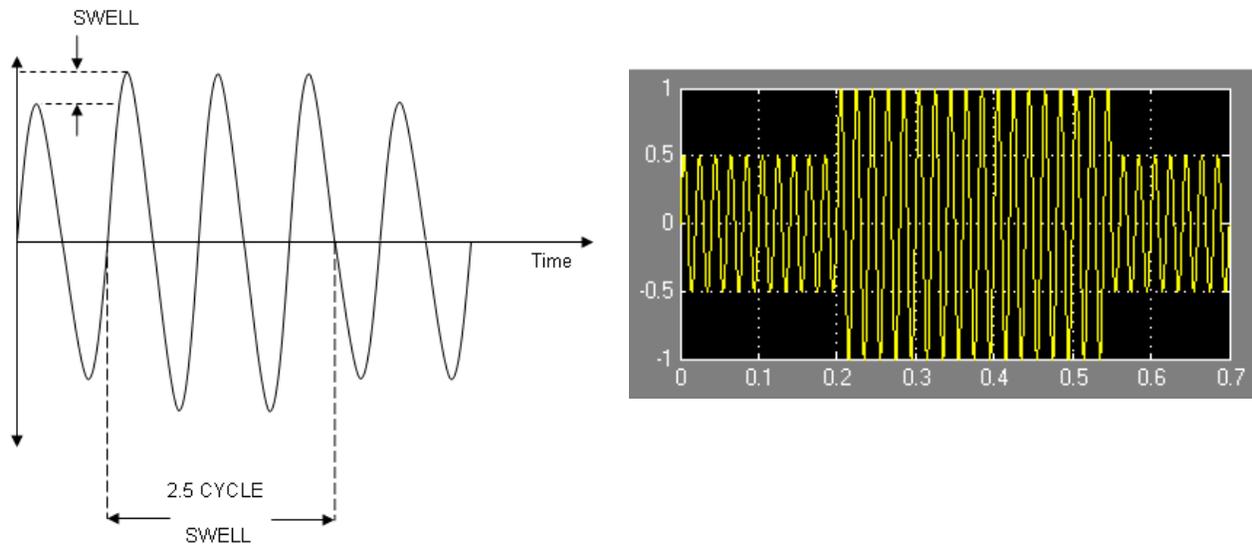


Figure 2.1(b) Voltage Swell

Typical end-use equipment sensitive to voltage sags are computers, programmable logic controllers, controller power supplies, motor starter contactors, control relays and adjustable speed drives.

Interruption

An interruption is defined as a reduction in line-voltage or current to less than 10 percent of nominal, not exceeding 60 seconds in length. Interruptions can be a result of control malfunction, faults, or improper breaker tripping. Figure 2.2 shows an interruption of approximately 1.7 seconds in length.

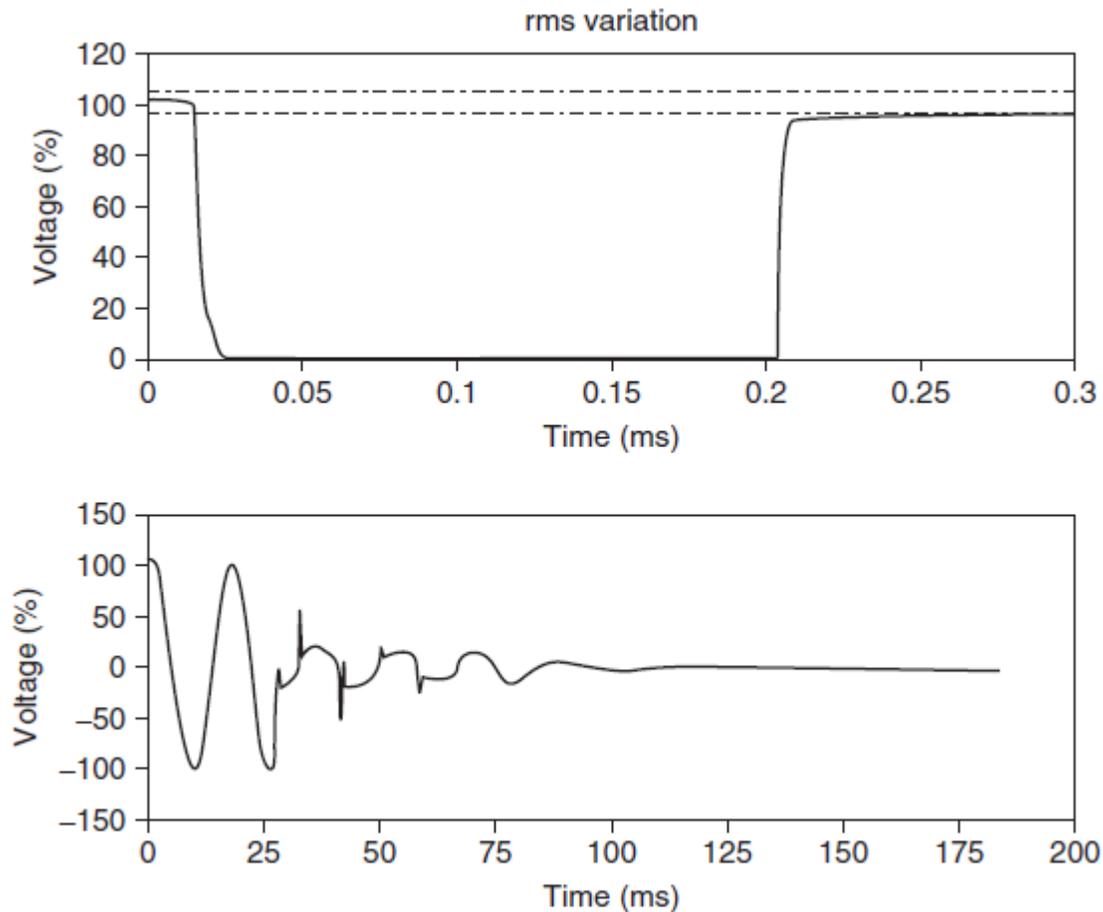


Figure 2.2 An interruption of approximately 0.17 seconds duration. The top trace is the rms line-voltage. The bottom trace is the first 200 milliseconds of the interruption.

Momentary interruptions (typically no more than 2 to 5 s) cause a complete loss of voltage and are a common result of the actions taken by utilities to clear transient faults on their systems. Sustained interruptions of longer than 1 min are generally due to permanent faults. Utilities have been faced with rising numbers of complaints about the quality of power due to sags and interruptions. There are a number of reasons for this, with the most important being that customers in all sectors (residential, commercial, and industrial) have more sensitive loads. The influx of digital computers and other types of electronic controls is at the heart of the problem. Computer controls tend to lose their memory, and the processes that are being controlled also tend to be more complex and, therefore, take much more time to restart.