**Unsymmetrical Faults -** Impact phases unequally, creating unbalanced currents with different magnitudes and phases.
- **Types:** Single line-to-ground, line-to-line, double line-to-ground, and open conductor faults.
- **Analysis:** Single-phase/per-unit analysis is not applicable; symmetrical components method is used.
- **Frequency:** Unsymmetrical faults are more common than symmetrical faults:
  - Single line-to-ground: ~70-80%
  - Line-to-line: ~15-20%
  - Double line-to-ground: ~10%
  - Symmetrical faults: ~1-3%

## Single Line-to-Ground Fault

- **Fault Condition:** Phase-a experiences a fault through an impedance, while fault currents at phases b and c are zero $I_{fb} = I_{fc} = 0$

- **Voltage at Fault Location (Phase-a):** $V_{ka} = Z_f I_{fa}$

- **Pre-Fault Voltage (Phase-a, Positive Sequence):** a = $V_F$

- Sequence components can be calculated as follows:

$$\begin{bmatrix} I_{fa}^0 \\ I_{fa}^1 \\ I_{fa}^2 \end{bmatrix} = \frac{1}{3}\begin{bmatrix} 1 & 1 & 1 \\ 1 & a & a^2 \\ 1 & a^2 & a \end{bmatrix}\begin{bmatrix} I_{fa} \\ I_{fb} \\ I_{fc} \end{bmatrix} = \frac{1}{3}\begin{bmatrix} 1 & 1 & 1 \\ 1 & a & a^2 \\ 1 & a^2 & a \end{bmatrix}\begin{bmatrix} I_{fa} \\ 0 \\ 0 \end{bmatrix} = \frac{1}{3}\begin{bmatrix} I_{fa} \\ I_{fa} \\ I_{fa} \end{bmatrix}$$

$$I_{fa}^0 = I_{fa}^1 = I_{fa}^2 = \frac{I_{fa}}{3}$$