Statistical Approach to Identify the Discharge Source in MV Cables and Accessories

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Introduction
Partial discharge (PD) activity is considered as one of the common mechanisms leading to failure of MV cable systems. Identifying the PD source based on the interpretation of the PD patterns assists the asset manager on decision making. This poster presents different patterns developed for on-line measurement. It also introduces the application of the statistical modeling to quantify the characteristics of these patterns and thereafter to reveal the defect types.

Test set-up
- MV grid at KEMA, The Netherlands
- Two main ring units, paper insulated lead covered (PILC) MV cable and an oil-filled joint.
- An artificial electrode-bounded defect in joint

PD Patterns
PD height pattern
- Different PD activity, produces different amplitude distribution
- Weibull model
  \[ F(q; \alpha, \beta) = 1 - \exp\left(-\frac{q}{\alpha}\beta\right) \]
- Shape parameter of Weibull is indicative of the defect type

PD mapping
- A plot of discharge magnitude vs. length
- Reveals the critical locations of the cable systems
- Critical location subjected to detailed analyses

Mini-net data analysis
Results:
- Weibull fits well to the PHD pattern
- Shape factor \( \beta = 2.27 \pm 0.15 \)
- Ceased activity in PD density pattern:
  - Formation of a carbon layer on the oil surface
  - Conductive path for the charges to leak
  - Preventing further PD activity

Field data analysis
- PILC cable connection
- Defect: Dry-out-of-Paper

Results:
- Weibull fits well to the PHD pattern
- Shape factor
  \( \beta = 1.29 \pm 0.01 \)

Conclusion
- Weibull provides a proper tool to quantify the discharge source characteristics
- Shape factor is indicative of the defect type
- PD density will be a step forward in reliable assessment of status of a defect