Bentley

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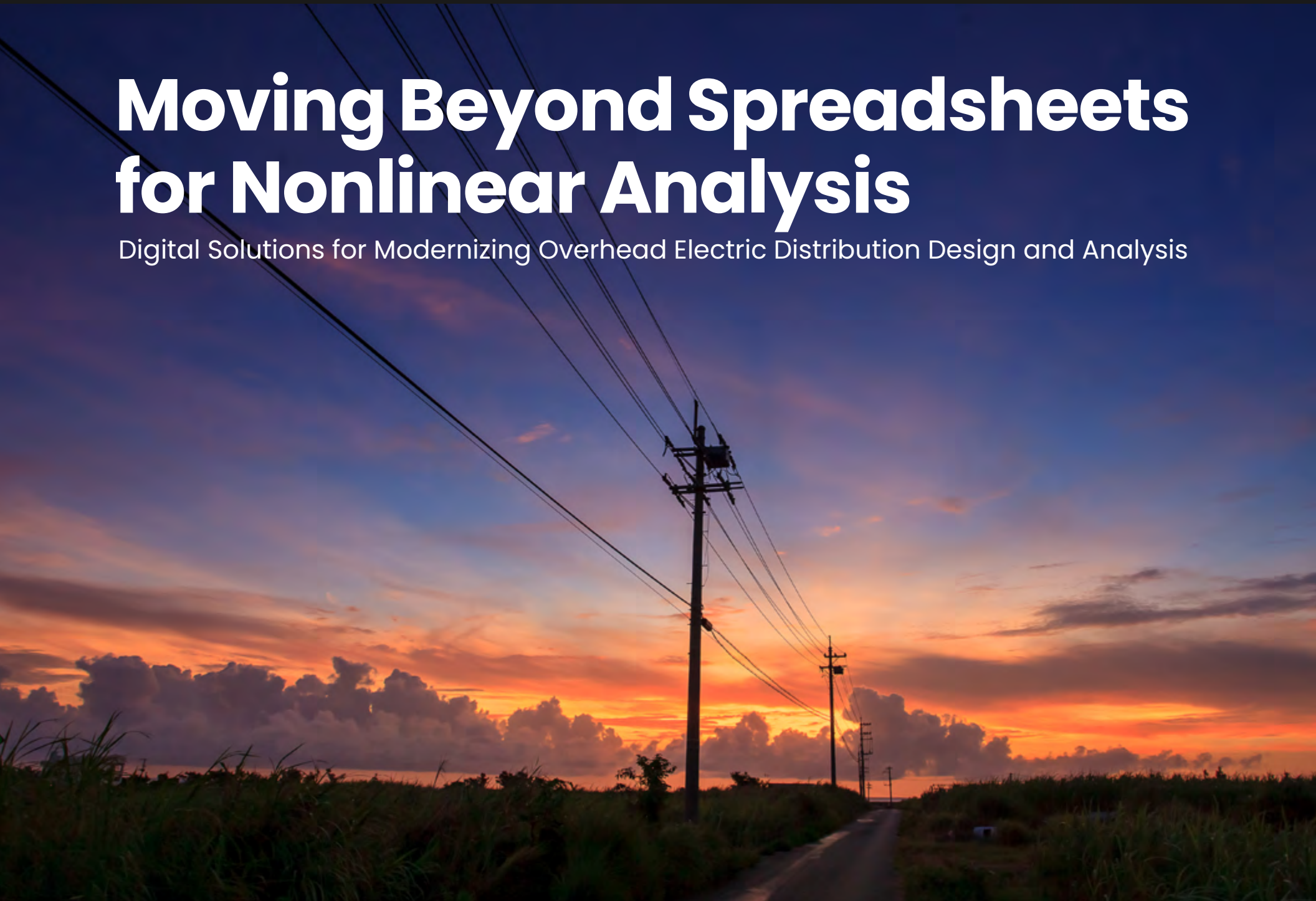
Moving Beyond Spreadsheets for Nonlinear Analysis

Digital Solutions for Modernizing Overhead Electric Distribution Design and Analysis



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Pushing Past the Boundaries of Spreadsheets

Spreadsheets are commonly used by engineers as they design and analyze overhead electric distribution systems. However, as regulations and standards are reviewed and updated, analysis requirements are becoming more complex and time consuming to model. The increasing frequency of severe storms has also become a significant factor. It is now critical to ensure utility poles are designed and constructed to withstand these weather conditions.

Consequently, spreadsheets have become inadequate for utility management and development. Moving beyond spreadsheets to a digital design and analysis solution enables a faster and more accurate approach that improves the resiliency, reliability, and safety of distribution networks.

Why Spreadsheets Were Used in Distribution Design and Analysis

Engineering standards for pole and guy/anchor loading have relied on spreadsheets for linear analysis calculations due to their availability and ease of use.

By building calculators within spreadsheets, engineers created a way to perform linear calculations for pole loading, guying, anchoring, and clearance reviews, such as evaluations, checks, and validations. Once spreadsheets were set up, they were easily shared with others. The tradition continued with utility workers using the same or similar spreadsheets for years.

Spreadsheets Are Powerful but Limited

While spreadsheet applications, such as Excel, are useful for linear analysis and basic calculations, they have significant limitations. These limitations are especially the case with overhead electric distribution design and analysis.

The Drawbacks of Relying on Spreadsheets

There are three critical drawbacks that utility companies face when using spreadsheets.

- **They Cannot Perform Geometric Nonlinear Analysis**
  Simply put, it is impossible to perform geometric nonlinear analysis using spreadsheets. With codes—such as those from the Canadian Standards Association (CSA)—establishing a standardized requirement to maintain compliance, as well as ensure the safety of the public, utilities now require capabilities beyond a spreadsheet.

- **Manual Calculations: One Spreadsheet Per Pole**
  Another major drawback to spreadsheets is manual calculations. They often require a separate spreadsheet to be created for each pole. This approach is not only time-consuming, but is also prone to errors while updating information. Separate spreadsheets also cause scattered information and decentralized data.

- **Spreadsheets Are Not Always Consistent and Reliable**
  Human error can compromise the consistency and reliability of spreadsheets, especially when some spreadsheets have been used for years and have not been reevaluated or updated. Mistakes in data entry or spreadsheet management can result in inaccurate calculations. Plus, spreadsheets are not designed to track when changes were made or who made them.

Extreme Weather Compounds Risks

- NASA researchers warn that as the planet continues to warm, extreme weather, such as floods, wildfires, droughts, and heat waves, will become more frequent and severe.
- Outages and damage to grid infrastructure pose a significant problem. Utility companies must run more simulations to ensure existing infrastructure can withstand extreme weather events.
- Climate scientists are increasingly able to predict weather forecasts with much more precision. With the right capabilities, utilities can plan for severe weather with more certainty and safety.

The Benefits of Overhead Electric Distribution System Analysis and Design Software

In today's rapidly evolving utility landscape, a unified, secure platform for structural analysis is crucial. SPIDAcalc™ centralizes all designs in one robust platform, moving beyond the traditional approach of storing data locally on individual computers or in shared files.

1. **Reduced Design Time**
   Quickly create pole designs by using standard or user-defined assemblies. Assemblies can be added to a single design or an entire pole line at once, substantially reducing design time.

2. **Optimized Design Workflows**
   Quickly create an overhead design using intuitive drag-and-drop functionality. Interact with a live 3D view or design an entire pole at once directly on the map.

3. **Reliable Analysis**
   Analyze an entire project by sending it to the cloud-based platform while simultaneously allowing users to continue working. SPIDAcalc provides scalable horsepower capable of analyzing thousands of complex poles in minutes.

4. **Meet Regulatory Standards and Public Safety**
   SPIDAcalc includes prebuilt components that conform to NESC, CSA, and GO95 safety code criteria, or you can build user-configured load cases.

5. **Minimized Underbuilding or Overbuilding Structures**
   Accurately assess design requirements and use the right amount of materials and labor to avoid the costs of overbuilding. This process ensures structures can handle expected loads, reducing failure risks and improving safety for workers and the public.

6. **Enabling Joint Use**
   Digital files can enhance the workflow of joint use attachments on utility poles, helping to coordinate multiple parties' effective sharing of infrastructure resources.

Use Case

Seamless Nonlinear Analysis

Utilities Kingston (UK), a shared multiutility provider, had to meet new standards in safety and environmental regulations for nonlinear analysis. Two-dimensional spreadsheets and manual calculations were not sufficient.

With SPIDAcalc, they simplified the design analysis process by using accurate 3D views and showcasing complex features. UK now has a cost-effective solution that reliably monitors the city's electrical utility infrastructure while ensuring compliance with regulatory requirements.

View Full Case Study

Utilities Kingston by the Numbers:

- 120,000 customers in Kingston, Ontario
- The utility provides water, gas, and electricity
- UK also operates a widely accessible and affordable fiberoptic broadband network with connectivity up to 10 gigabits per second

Results: UK streamlined their design analysis workflows and processed 30 iterations of each pole within 10 to 20 minutes, potentially saving months of time. They can now consistently meet CSA regulatory requirements for nonlinear analysis.

Use Case

Consistency in Pole Design and Analysis

BC Hydro needed to ensure compliance with new CSA regulations for geometric nonlinear analysis for pole loading. In the past, they would perform linear calculations and clearance by hand using lookup tables or Excel-based calculators.

Using SPIDAcalc's intuitive interface, users ensured design consistency, resulting in a robust pole design that met code requirements. SPIDAcalc also helped streamline internal and external processes with contractors, identified the effect of third-party telecom attachments, and optimized operational efficiency. BC Hydro reduced risk while increasing public safety.

View Full Case Study

BC Hydro by the Numbers:

- BC Hydro is owned by the government and people of British Columbia, Canada
- The organization generates and delivers electricity to 95% of the population
- It services 5,000,000 customers
- BC Hydro uses over 400 SPIDAcalc licenses

Results: By adopting SPIDAcalc, BC Hydro updated and validated standards that meet requirements for geometric nonlinear analysis for pole loading throughout their organization, as well as externally with contractors.

A Critical Solution

Digital Design and Analysis

Traditionally, engineers have used spreadsheets as calculators for linear analysis. However, updated standards for geometric nonlinear analysis and increasingly complex designs, coupled with environmental risks and extreme weather, have made this approach inadequate.

Migrating design and analysis workflows from spreadsheets to digital design solves critical challenges for overhead electric distribution systems. Applying advanced design applications, such as SPIDAcalc, makes the process faster and more reliable. It enables improved accuracy, streamlined internal and external operations, boosted data access, and, ultimately, enhanced resiliency, reliability, and safety.

See SPIDAcalc in Action

Request a Demo