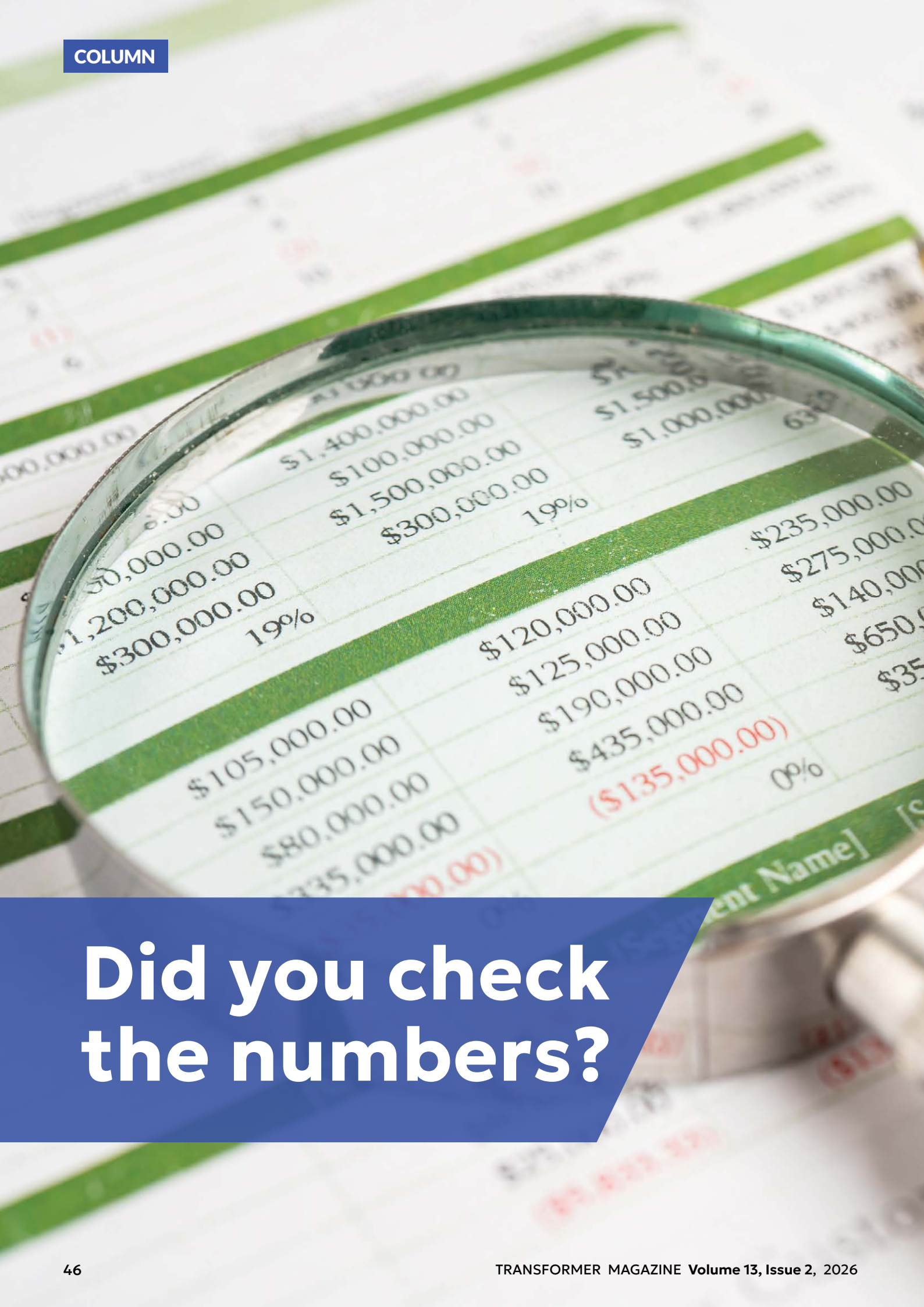
COLUMN



Did you check the numbers?


Returns
$3,750.00
$70,000.00
$27,500.00
$35,000.00

COLUMN

It's not necessarily obvious that small changes to a plan, or a seemingly simple data analysis, could have devastating consequences

It's not necessarily obvious that small changes to a plan, or a seemingly simple data analysis, could have devastating consequences, which is why we need to check numbers, check calculations, and then check again.

In transformer terms, we have to: check specifications meet or exceed the need; check designs are appropriate; perform witness testing at the factory to ensure we build what is specified; and then transport the unit safely and without incident to site for installation, commissioning and operation. Small changes could happen at every stage of the process, and the stories given briefly here, though not directly related to transformers, are all indicative of a need to check both data analyses and design changes and what they mean "in the real world" [1].

In 1980, the Kansas City Hyatt Regency added walkways to the hotel, suspended by threaded metal rods above the hotel reception. The weight of each walkway was supported by nuts threaded onto the supporting rods, but a small change on the design, splitting the rods to reduce the need to thread the nuts a long way up the rods, meant that some of them now bore twice the original intended weight. In July of 1981 the walkways collapsed and over 100 people died. No one had checked that the new design would be able to support the redistributed weights. Small change, big outcome [2].

In 1978, an engineering student project gave an analysis of the recently built Citicorp Center building and identified that there was a problem: long multi-story steel braces to give structural support were supposed to be welded but were, in fact, bolted to save money and were not as strong as needed. That change meant that under a suitably strong wind the building could collapse, potentially killing thousands of people in the neighborhood. The design change was made during construction and was not

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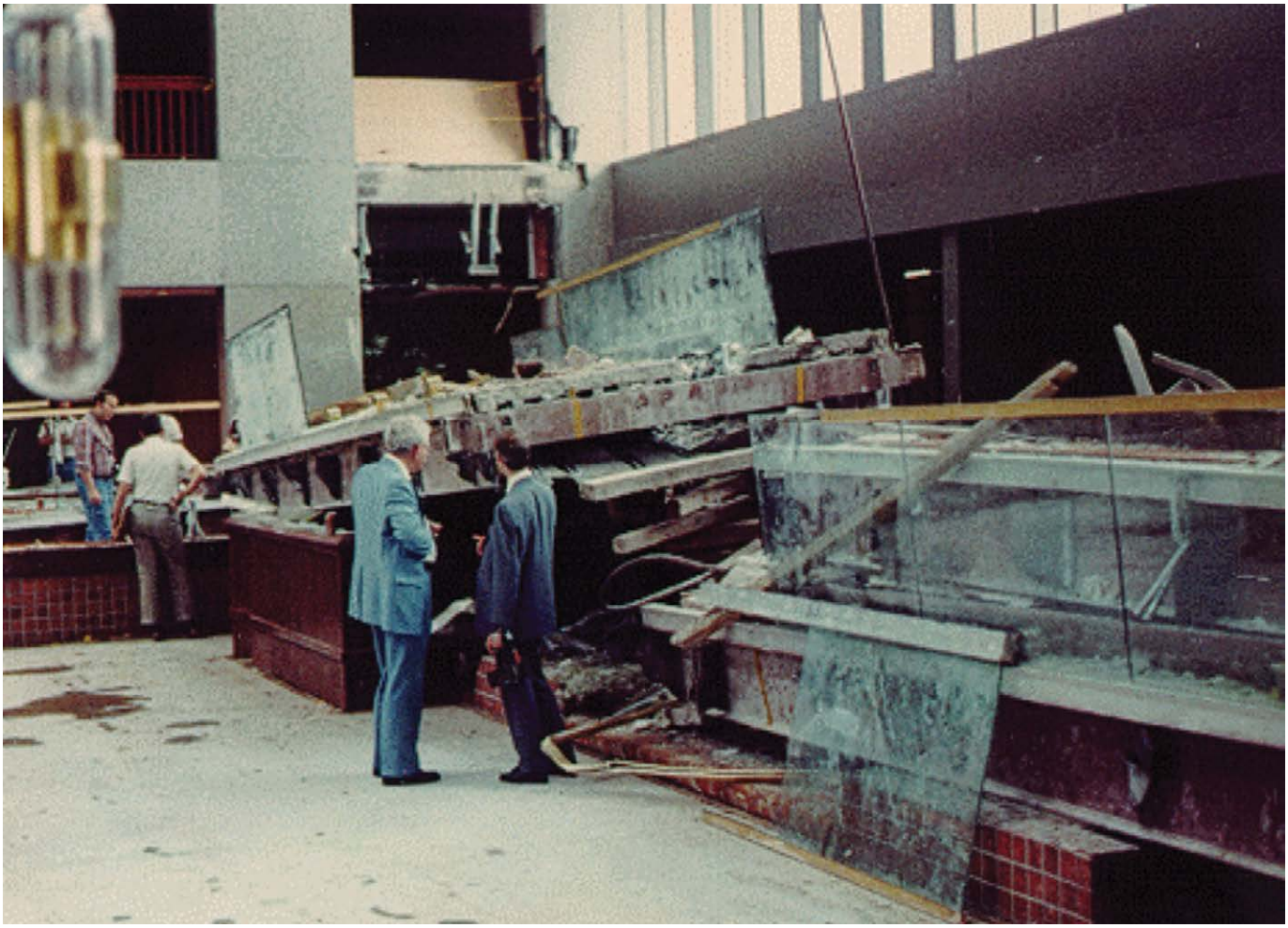

Hyatt Regency walkway collapse, 1981. Source: Dr. Lee Lowery, Jr., P.E. / Wikimedia Commons (public domain)

relayed to the designer who would have identified the problem. “Repairs” began in August 1978 without the issue being made public, even though Citicorp had drawn up evacuation plans should they be needed. Hurricane Ella, with very strong winds could have caused the evacuation to be required, but turned away from New York City only hours before such an evacuation would have been needed. A small change in construction could have had catastrophic consequences [3].

The European Spreadsheet Risks Interest Group, EuSpRiG, is a useful source for public reports of spreadsheet errors causing unforeseen consequences [4]. One case looks at the work of economists Reinhart and Rogoff whose seminal paper “Growth in a Time of Debt” built on their reputation for historical financial analysis and “showed” that high public debt for a country compared to its Gross Domestic Product (GDP) is associated with lower, possibly negative, median economic growth. The work helped justify austerity measures in several locations. Then it was found that their analysis was based on flawed spreadsheet calculations which removed several countries from the analyses and which, when corrected, removed the association between debt and growth: the austerity measures were not really justified [5]. There are a huge number of spreadsheets in use around the world – how many of them have been thoroughly audited to make sure they are doing exactly what they are supposed to be doing? In the specific case of the Enron accounting scandal, results were found when analyzing spreadsheets in use that 24% of spreadsheets with at least one formula had an error [6]. In more recent reports from Forbes and the Financial Times on spreadsheets in general use, they found that “88% of all spreadsheets have errors in them” from simple mistakes in formulae to bad design [7]!

There are a huge number of spreadsheets in use around the world – how many of them have been thoroughly audited to make sure they are doing exactly what they are supposed to be doing?

Small errors in a calculation may have big consequences.

Statistics and probabilities can lead to data misinterpretation and, in some

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cases, to "the misuse of statistics in the courts". Sally Clark was arrested and put on trial in 1999 after her two sons had both died of Sudden Infant Death Syndrome (SIDS). The prosecution case rested on evidence from a pediatrician who stated that the chance of two SIDS deaths was 1 in 73 million, based on the chance that a single such death happened in about 1 in 8500 cases. Clark spent three years in jail before her conviction was overturned – the clear misuse of statistics being a key element of her exoneration [8].

Validating design changes and identifying inappropriate analyses should be standard practice as "it seemed like a good idea at the time" is not much comfort to those who may have to pick up the pieces later. My suggestion would be to thoroughly vet any spreadsheet or statistical calculation via an expert in the field, for example a friendly professor at a local college, and to check every possible impact of design changes made after the original design has been agreed upon. To use a common phrase: "get it checked by grown ups".

References

[1] M. Parker, "Humble Pi", ISBN: 9780141989143

[2] https://en.wikipedia.org/wiki/Hyatt_Regency_walkway_collapse

[3] https://en.wikipedia.org/wiki/Citicorp_Center_engineering_crisis

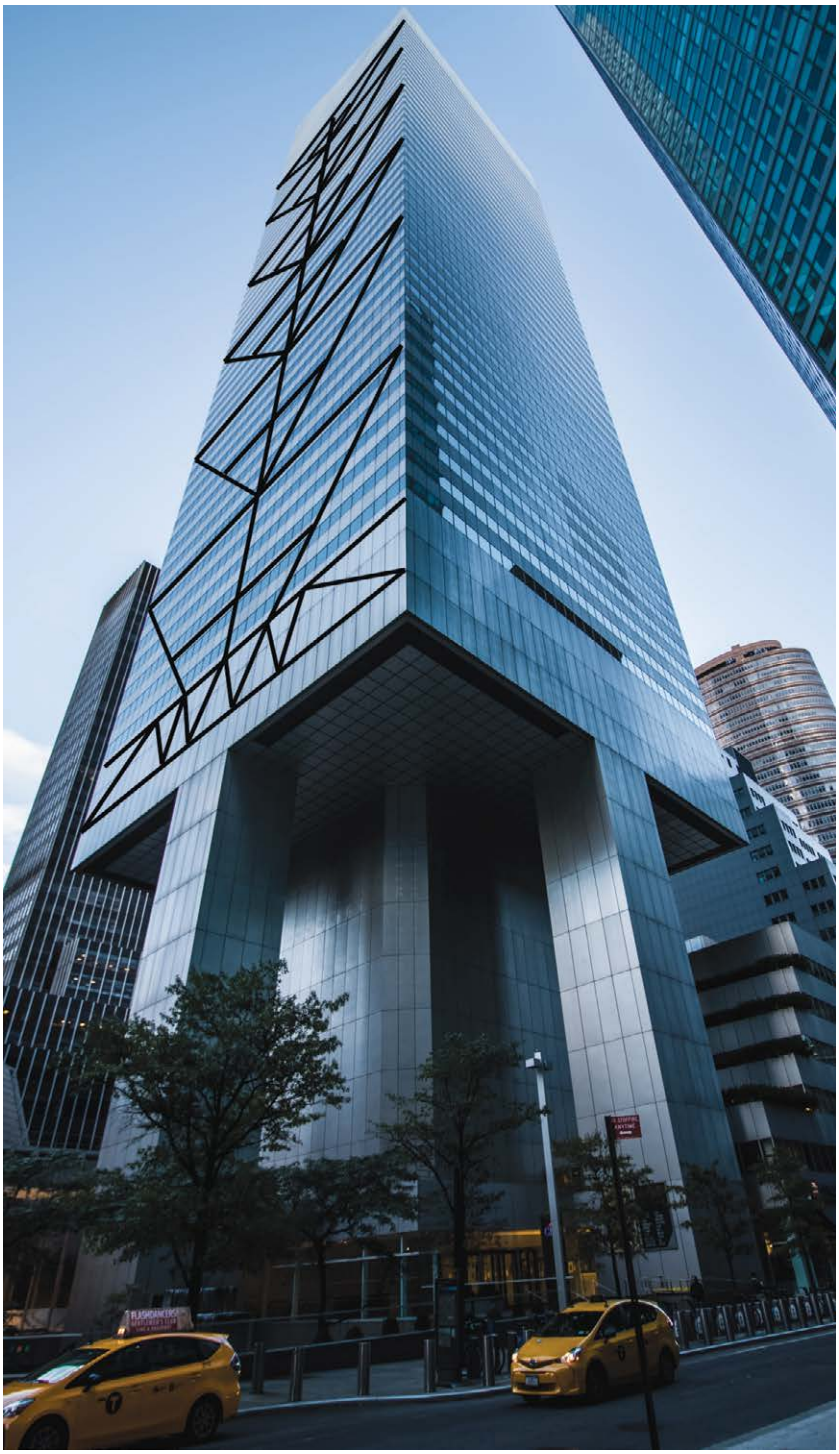
[4] https://eusprig.org/research-info/horror-stories/

[5] https://www.nytimes.com/2013/04/30/opinion/debt-and-growth-a-response-to-reinhart-and-rogoff.html

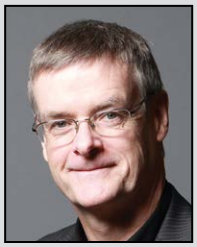
[6] https://ieeexplore.ieee.org/document/7202944

[7] https://www.linkedin.com/pulse/alarming-reality-spreadsheet-errors-insights-from-harris-fice-ywzie/

[8] https://en.wikipedia.org/wiki/Sally_Clark



Authors



Dr. Tony McGrail of Doble Engineering Company provides condition, criticality, and risk analysis for substation owner/operators. Previously Dr. McGrail spent over 10 years with National Grid in the UK and the US as a Substation Equipment Specialist, with a focus on power transformers, circuit breakers, and integrated condition monitoring. Tony also took on the role of Substation Asset Manager to identify risks and opportunities for investment in an ageing infrastructure. Dr. McGrail is an IET Fellow, past-Chairman of the IET Council, a member of IEEE, ASTM, ISO, CIGRE, and IAM, and a contributor to SFRA and other standards.