GEORGE J. ANDERS, Ph.D., P.Eng., Fellow IEEE

George Anders is a president of Anders Consulting. Between 1975 and 2012 he has been employed by Ontario Hydro and its successor companies in Toronto, Canada. He has been a Principal Engineer/Scientist in the Electrical Systems Technologies Department of Kinectrics Inc. for many years. Dr. Anders is a professor in the Faculty of Electrical and Electronic Engineering of the Technical University of Lodz in Poland and an Adjunct Professor in the Department of Electrical and Computer Engineering at the University of Toronto. For many years, Dr. Anders has been Ontario Hydro's resource person responsible for the development of power cable calculation methods and application of advanced techniques in power system analysis.

Throughout his 36 years with Ontario Hydro and the successor companies, Dr. Anders has been involved in several aspects of power system analysis and design. His principal activities have been concentrated in three areas: (1) ampacity computations of electric power cables, (2) application of probability methods in power system analysis and design, and (3) application of novel techniques in electric power utility practice. He is the author of three books and has written over 90 papers published in several international journals and a similar number of papers published in various conference proceedings. He has been conducting seminars in Canada and the USA as well as in Antigua, Australia, Brazil, Chile, China, Colombia, France, Greece, Hong Kong, Italy, Malaysia, Oman, Poland, Portugal and in the United Arab Emirates.

Dr. Anders has published over 60 papers on the subjects dealing with thermal analysis of underground systems and several of the computational models have been implemented in the 60287 series of the IEC Standards. Dr. Anders is an author of two books "Rating of Electric Power Cables - Ampacity Computations for Transmission, Distribution and Industrial Installations" published in January 1997 and "Rating of Electric Power Cables in Unfavorable Thermal Environment" published in 2005. Both books were published by IEEE Press in their Power System Reference Series. As recognition of his work in this field, he received from Ontario Hydro a New Technology Award in 1990.

Dr. Anders is a Canadian representative and co-convener of Working Group 19 (ampacity computations of power cables and short circuit temperatures of power cables) of the International Electrotechnical Commission (IEC). This working group develops new computational techniques and new standards for power cable ampacity computations. He has also been a project leader on a number of projects dealing with ampacity computations sponsored by the Canadian Electrical Association. In the course of these projects, a series of highly successful computer programs were developed for CEA and distributed by CYME Int. These programs are in use by over 400 institutions in 50 countries on 5 continents and are de facto industry standard for power cable rating calculations. In 2007 Dr. Anders received a prestigious 1906 Award from the IEC for his work on cable rating calculations. Dr. Anders is also involved in the development of novel techniques for dielectric fluid leak detection in pipe type cables. These methods utilize a minimal amount of measured information and employ artificial intelligence algorithms and probabilistic networks for decision making. Several installations in the U.S. and in Canada are being tested. Another field of application in which Dr. Anders is involved is the development and installation of real time rating systems for underground power cables. Several dynamic rating systems whose software was designed by Dr. Anders are installed around the world.

In the field of application of probability methods in power system engineering, Dr. Anders has been involved in developing new methods and applications of probabilistic techniques to power system problems since 1975. He has published over 50 papers dealing with various topics on probability and optimization applications. For several years Dr. Anders has been teaching a course in the Faculty of Applied Science and Engineering at the University of Toronto on application of probability methods in engineering. His book on *Probability Concepts in Electric Power Systems* (Wiley, New York, 1990) is well recognized around the world as a unique reference on the application of probability methods in power system planning, design and operation.

George J. Anders received a Masters Degree in Electrical Engineering from the Technical University of Lodz in Poland in 1973 and a M.Sc. Degree in Mathematics and Ph.D. Degree in Power System Reliability from the University of Toronto in 1977 and 1980, respectively. In 2000 he received a Doctor of Science Degree from the University of Lodz. Dr. Anders is a registered Professional Engineer in the Province of Ontario and a Fellow of

IEEE with memberships in the Power & Energy and Industry Applications Societies. He is also a Project Management Professional registered by the Project Management Institute.

Ampacity Management of Cables

Overview

Aging infrastructure in electric transmission systems forces utilities to put closer look at the asset utilization. Electric power cables have been sized very conservatively in the past. This presentation will review the most important issues in cable ampacity calculations. It will analyze how cable construction and location influences the amount of current the circuit can carry. It will also address some new trends in cable rating calculations including examples of the real time rating systems.

Presentation Outline:

Background on Cable Ampacity Calculations

- What are ampacity calculations
- Why are they needed
- Some history

Important Aspects of the rating calculations

- Influence of cable construction on its rating
- The effect of cable external environment
- The effect of other heat sources
- Rating calculations for grouped cables laid underground or in air

Available Tools for Cable Rating Calculations

- Analytical methods
- Numerical methods
- Hybrid methods

Demonstration of Modern Computer Programs for Cable Rating Calculations

- A commercial computer program based on international standards
- Finite element program for complex cable arrangements

Rating of Cables in Unfavorable Thermal Environments and Cables in Deep Tunnels

- Cables crossing other cables and heat sources
- Cables crossing short unfavorable regions
- Cables in deep tunnels

Real time Ratings

- The principles of real time rating calculations
- Input data requirements
- Verification of the results

Who Should Attend?

This course is designed for:

- Engineers and technicians designing and operating transmission systems
- Power cable engineers and technologists.

Key Benefits:

Gain an understanding of:

- Basics of ampacity calculations
- Computer programs and expert tools
- Emerging issues in ampacity calculations

Energy Loss Management in Electric Utility Distribution Systems

Energy Loss within Distribution Networks is a critical issue that can result in increased costs to clients and is a major concern of regulatory bodies such as the Ontario Energy Board. Utility engineers need to understand the course of the losses, the methods for estimating the losses, and how to reduce the losses in a cost-effective manner. This presentation will review the knowledge and calculation methods for estimating losses, and discuss techniques to reduce potential loss.

Presentation Outline:

Sources of Load Losses

- **Types**
- **Equipment**
- **Parameters**
- **Typical values**

Sources of No Load Losses

- **Types**
- **Equipment**
- **Parameters**
- **Typical values**

Estimation Techniques

- **Energy In — Energy Out**
- **Engineering Estimates**
- **Sample Results**
- **Accuracy of Estimates**

Loss Allocation Issues

- **Traditional Method**
- **Proposed Methods**
- **Issues of Fairness**

Loss Reduction Techniques

- **Circuit Balance**
- **Phase Balance**
- **Capacitor Banks**
- **Conductor Change**
- **1-Phase to 3-Phase Conversion**
- **Increasing Voltage**
- **Loading of transformers**
- **Shorter Circuits**
- **Flatten Load Profile**
- **Distributed Generation**

Cost Effectiveness of Loss Reduction

- **Cost of energy and power**
- **Financial Comparisons**

Who Should Attend?

The audience for this presentation includes:

- **Utility Engineers**
- **Regulators**
- **Consultants**
- **Large commercial, and manufacturing electricity users**

IDEAS IN IMPORATNCE RANKING OF TRANSMISSION FACILITIES

Overview

Transmission lines and power transformers at transmission substations represent a major portion of the bulk transmission systems and these assets must perform well in order to achieve a high level of system reliability. Such high performance can be achieved if there are no budget restrictions. In many cases, budget constraints have been imposed, and the owner of the system has to set priorities with regard to the work that needs to be done on these transmission components. Depending on the network configuration and how loads and generators are connected to the network, the consequences of transmission component outages could be more or less significant. The intent of this presentation is to review the methodology to rank critical facilities in a transmission network. Several approaches to solving this problem will be discussed. A distinction is made between ranking transmission network components and ranking substations.

Presentation Outline:

Facilities Ranking Concepts

- Why to rank facilities
- Parameters that might affect ranking
    - Network structure
    - Loading of components
    - Importance to the system

Ranking of transmission lines

- Load flow as a starting point
- Ranking of contingencies – New performance index
- Graph theory approach
- Subjective importance factors
    a. Transmission Grid Parameters
        - Supports major generation
        - Major transmission right-of-way
        - Large step-down transformers
        - Major intertie
        - Regional source lines
        - River crossing
        - Cost of maintenance or difficult to repair
        - Intermediate load service
        - Etc.

    b. Parameters
        - Public health and safety
        - National security
        - Regional economy
        - Location with respect to population centers, transportation corridors, and other lifelines
        - etc.

Ranking of substations

- Station Reliability, which considers all forced automatic and manual outages at a substation in a given time period;
- Station Security, which examines the overlapping outages caused by faults on substation components; and,
- Station Safety, which takes into account hazardous events and the number of alarms at each substation in a specified time period.

Substation component importance

- Ranking substation components based on their contribution to the system failure probability

Who Should Attend?

This presentation is designed for:

- Power System Planners
- Power System Operators
- Regulators