

# How to Write an Effective Technical Paper

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IEEE PES Bangalore Chapter  
Webinar, 06 August 2020

## Webinar Speaker,

Saifur Rahman, Ph.D.

Professor and Director

Virginia Tech Advanced Research Institute



### Education

Ph.D., Electrical Engineering, Virginia Polytechnic Institute and State University, 1978.

M.S., Electrical Sciences, State University of New York at Stony Brook, 1975.

B.Sc., Electrical Engineering, Bangladesh University of Engineering and Technology, Dhaka, 1972

### Professional Society Activities

- IEEE Member since 1975, Fellow 1998, Life Fellow 2014
- President, IEEE PES, 2018-2019
- Vice president, Publications, IEEE PES, 2001-2003, 2012-2013
- Vice President, Publications, IEEE, 2006
- Editor-in-Chief, IEEE Transactions on Sustainable Energy, 2010-2012
- Editor-in-Chief, IEEE Electrifications Magazine, 2013-2014
- Launched, the IEEE Power & Energy Technology Systems Journal (Open Access), 2014

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## Writing Quality Technical Papers (Webinar)

### Authoring Webinar

#### Presenter

Saifur Rahman, Ph.D.  
Professor and Director  
Virginia Tech Advanced Research Institute



#### Education

Ph.D., Electrical Engineering, Virginia Polytechnic Institute and State University, 1978.  
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# Audience



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**Audience**

## **Basic Questions**

1.Are you writing this paper for the sake of writing a paper?

2.Or do you want to show how others can benefit from your work?

## Audience

# Scientific research publishing

- Who writes scientific papers?
  - Engineers, scientists, educators and researchers from:
    - Corporations
    - Academia
    - Government
  - Students typically write and present conference papers before submitting journal articles



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## Audience

# What IEEE editors and reviewers are looking for

- Content that is appropriate, in scope and level
- Clearly written original material that addresses a new and important problem
- Extension of previously published work
- Valid methods and rationale
- Illustrations, tables and graphs that support the text
- References that are current and relevant to the subject

## Audience

# How does the review process work?

- Editor-in-Chief gets the paper after it goes through content match check (iAuthenticate) and “banned author” check
- If the paper is in scope for the journal, it is assigned to an editor (associate editor)
- Editor assigns the paper to five or more reviewers
- Reviewers send their comments back to the editor
- Editor makes a recommendation to the EIC as follows:
  - Accept
  - Revise & Resubmit
  - Reject
- The EIC makes the final decision and informs the corresponding author

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## Audience

# Why IEEE editors and reviewers reject papers

- The content is not a good fit for the publication
- There are serious scientific flaws:
  - Inconclusive results or incorrect interpretation
  - Fraudulent research
- It is poorly written
- It does not address a big enough problem or advance the scientific field
- Most of the work was previously published
- The quality is not good enough for the journal
- Reviewers have misunderstood the article

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# Structure

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# Paper Structure

## Elements of a manuscript

Title

Abstract

Keywords

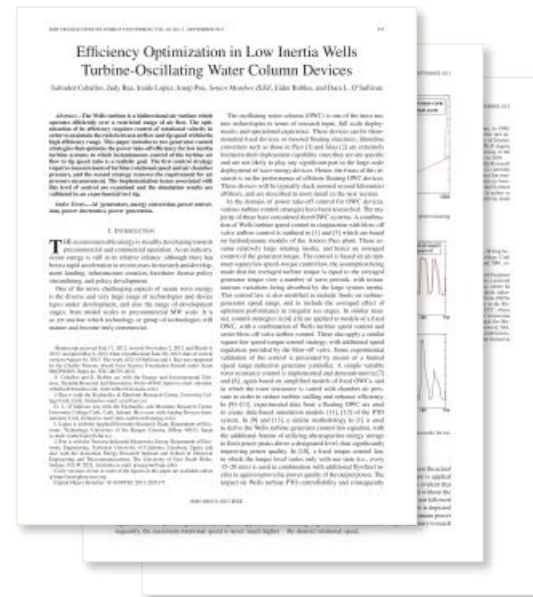
Introduction

Methodology

Results/Discussions/Findings

Conclusion

References



## Paper Structure

# Title

An effective title should...

- Answer the reader's question:  
*"Is this article relevant to me?"*
- Grab the reader's attention
- Describe the content of a paper using the fewest possible words
  - Is crisp, concise
  - Uses keywords
  - Avoids jargon

Good  
Title

VS.

Bad  
Title

## Title Dos and Don'ts

- ✓ *A Human Expert-based Approach to Electrical Peak Demand Management*
- VS
- ✗ *A better approach of managing environmental and energy sustainability via a study of different methods of electric load forecasting*

## Paper Structure

# Abstract

A “stand alone” condensed version of the article

- No more than 250 words; can use past or present tense
- Uses keywords and index terms

**Why they're useful & important  
& move the field forward**

**Why you did it**

**What you did**

**How the results  
were useful,  
important & move  
the field forward**

## Paper Structure

# Abstract Dos and Don'ts



The objective of this paper was to propose a human expert-based approach to electrical peak demand management. The proposed approach helped to allocate demand curtailments (MW) among distribution substations (DS) or feeders in an electric utility service area based on requirements of the central load dispatch center. Demand curtailment allocation was quantified taking into account demand response (DR) potential and load curtailment priority of each DS, which can be determined using DS loading level, capacity of each DS, customer types (residential/commercial) and load categories (deployable, interruptible or critical). Analytic Hierarchy Process (AHP) was used to model a complex decision-making process according to both expert inputs and objective parameters. Simulation case studies were conducted to demonstrate how the proposed approach can be implemented to perform DR using real-world data from an electric utility. Simulation results demonstrated that the proposed approach is capable of achieving realistic demand curtailment allocations among different DSs to meet the peak load reduction requirements at the utility level.

**Vs**



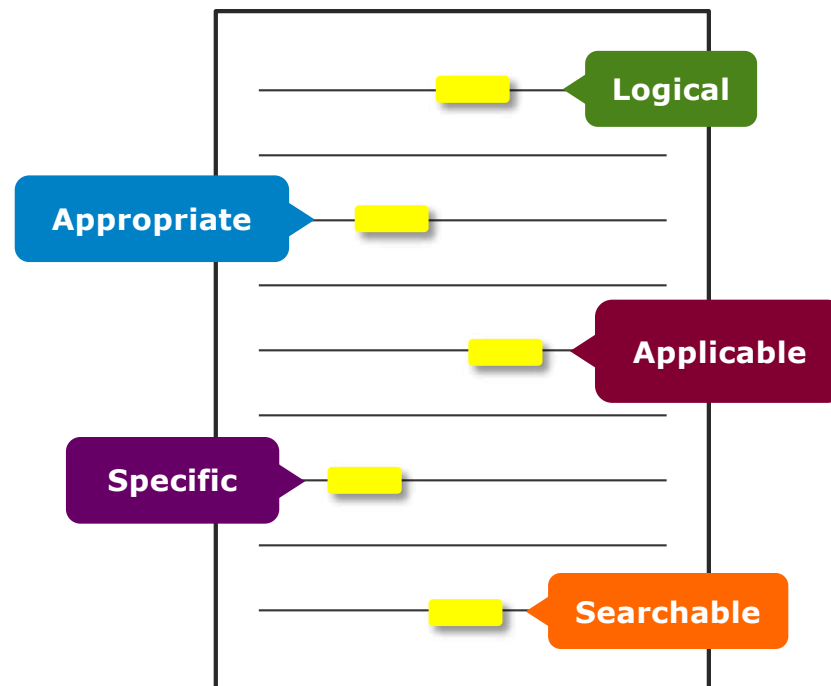
This paper presents and assesses a framework for an engineering capstone design program. **We explain** how student preparation, project selection, and instructor mentorship are the three key elements that must be addressed before the capstone experience is ready for the students. **Next, we describe** a way to administer and execute the capstone design experience including design workshops and lead engineers. **We describe the importance** in assessing the capstone design experience and report recent assessment results of our framework. **We comment** specifically on what students thought were the most important aspects of their experience in engineering capstone design and provide quantitative insight into what parts of the framework are most important.

***First person, present tense***

***No actual results, only describes the organization of the paper***

## Paper Structure Keywords

Use in the Title and  
Abstract for enhanced  
Search Engine Optimization



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## Paper Structure

# Introduction

- A description of the problem you researched
- It should move step by step through:

Generally known information about the topic

Prior studies' historical context to your research

Your hypothesis and an overview of the results

How the article is organized

- The introduction should be:
  - Specific, not too broad or vague
  - About 1-2 pages
  - Written in the present tense

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## Paper Structure

# Methodology

- Problem formulation and the processes used to solve the problem, prove or disprove the hypothesis
- Use **illustrations** to clarify ideas and support conclusions:

### Tables

Present representative data or when exact values are important to show



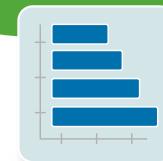
### Figures

Quickly show ideas/conclusions that would require detailed explanations



### Graphs

Show relationships between data points or trends in data



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# Paper Structure

## Results/discussion

Demonstrate that you solved the problem or made significant advances

### Results: Summarizes the Data

- Should be clear and concise
- Use figures or tables with narrative to illustrate findings

### Discussion: Interprets the Results

- Why your research offers a new solution
  - How can it benefit other researchers
- professionals

### Discussion

### Results

IMENETOVIC *et al.*: LST ESTIMATION METHODS FROM LANDSAT-4 THERMAL INFRARED SENSOR DATA

1803

the SC algorithm over the whole range of  $w$  values increase to 3–4 K, except for the TIGR-111 database, with an RMSE of 2 K. This just results is explained by the  $w$  distribution, which is biased toward low values of  $w$  in this database. When only atmospheric profiles with  $w$  values lower than  $3 \text{ g} \cdot \text{cm}^{-2}$  are selected, the SC algorithm provides RMSEs around 1.5 K, with almost equal values of bias and standard deviation, around 1 K in both cases (with a negative bias, thus the SC underestimates the LST). In contrast, when only  $w$  values higher than  $3 \text{ g} \cdot \text{cm}^{-2}$  are considered, the SC algorithm provides RMSEs higher than 2 K. In these cases, it is preferable to calculate the atmospheric functions of the SC algorithm directly from (3) rather than approximating them by a polynomial fit approach as given by (4).

#### V. DISCUSSION AND CONCLUSION

The two Landsat-5 TIR bands allow the intercomparison of two LST retrieval methods based on different physical assumptions, such as the SC (only one TIR band required) algorithm (two TIR bands required). Down inversion  $w$  transfer function, which can be considered as a "ground-truth" condition, is assumed to be a "ground-truth" condition that the information about the ground  $L_d$  is accurate enough. The SC algorithm presented in this letter is a continuation of the previous SC algorithm developed for Landsat-4 and Landsat-5 TM4 sensors, and the ETM+ sensor on board the Landsat-7 platform [9], and it could be used to generate consistent LST products from the historical Landsat data using a single algorithm. An advantage of the SC algorithm is that, apart from surface emissivity, only water vapor content is required as input. However, it is expected that errors on LST become unacceptable for high water vapor contents (e.g.,  $> 3 \text{ g} \cdot \text{cm}^{-2}$ ). This problem can be partly solved by computing the atmospheric functions directly from  $\tau$ ,  $L_w$ , and  $L_d$  values [see (2)], or else by including air temperature as input [10]. A main advantage of the SW algorithm is that it performs well over global conditions and, thus, a wide range of water vapor values; and that it only requires water vapor as input (apart from surface emissivity at the two TIR bands). However, the SW algorithm can be only applied to the new Landsat-8 TIRS data, since previous TM/ETM sensors only had one TIR band.

The LST algorithms presented in this letter were tested with simulated data sets obtained for a variety of global atmospheric conditions and surface emissivities. The results showed RMSE values of typically less than 1.5 K, although for the SC algorithm, this accuracy is only achieved for  $w$  values below  $3 \text{ g} \cdot \text{cm}^{-2}$ . Algorithm testing also showed that the SW errors are lower than the SC errors for increasing water vapor, and vice versa, as demonstrated in the simulation study presented in Sobrino and Jiménez-Muñoz [15]. Although an extensive validation exercise from *in situ* measurements is required to assess the performance of the two LST algorithms, the results obtained for the simulated data, the sensitivity analysis, as well as the previous findings for algorithms with the same mathematical structure give confidence in the algorithm accuracies estimated here.

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## Paper Structure

# Conclusion

- Explain what the research has achieved
  - As it relates to the problem stated in the Introduction
  - Revisit the key points in each section
  - Include a summary of the main findings and implications for the field
- Provide benefits and shortcomings of:
  - The solution presented
  - Your research and methodology
- Suggest future areas for research



# Paper Structure References

- Support and validate the hypothesis your research proves, disproves or resolves
- There is no limit to the number of references
  - But use only those that directly support your work (about 30)
- Ensure proper author attribution
  - Author name, *article title*, publication name, publisher, year published, volume and page number, Digital Object Identifier (DOI)

Properly  
cited  
material

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We then have

$$\begin{aligned} (P_t^{h,+} + P_t^{h,-})^2 &= (P_t^{h,+} - P_t^{h,-})^2 + 4P_t^{h,+}P_t^{h,-} \\ &< (P_t^{h,+} - P_t^{h,-})^2 + 4P_t^{h,+}P_t^{h,-} \\ &= (P_t^{h,+} + P_t^{h,-})^2. \end{aligned} \quad (32)$$

Since  $P_t^{h,+} - P_t^{h,-} = P_t^{h,+} - P_t^{h,-}$ , we then have  $P_t^{h,+} < P_t^{h,-}$ , and  $P_t^{h,-} < P_t^{h,+}$ . Because the operational cost is an increasing function of  $(P_t^{h,+}, P_t^{h,-})$ , we obtain that

$$c_{h,t}(P_t^{h,+}, P_t^{h,-}) < c_{h,t}(P_t^{h,+}, P_t^{h,-}). \quad (33)$$

Therefore the optimal pair  $(P_t^{h,+}, P_t^{h,-})$  must satisfy that  $P_t^{h,+}P_t^{h,-} = 0$ , i.e., only one of  $P_t^{h,+}, P_t^{h,-}$  can be non-zero. ■

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Arya Nehorai (S'70-M'73-SM'76-F'94) received the B.Sc. and M.Sc. degrees from the Technion, Haifa, Israel, and the Ph.D. degree from Stanford University, Stanford, CA, USA. He is the Eugene and Martha Lehman Professor and Chair of the Preston M. Green Department of Electrical and Systems Engineering (ESE) at Washington University in St. Louis (WUSTL), St. Louis, MO, USA. Earlier, he was a faculty member at Yale University and the University of Illinois at Chicago. Dr. Nehorai served as Editor-in-Chief of IEEE Transactions on Signal Processing from 2005 to 2012. From 2003 to 2005 he was the Vice President of the IEEE Signal Processing Society (SPS), the Chair of the Publications Board, and a member of the Executive Committee of the Society. He was the founding Editor of the special columns on Leadership Reflections in IEEE Signal Processing Magazine from 2003 to 2006. He has been a Fellow of the IEEE since 1994, the Royal Statistical Society since 1996, and the AAAI since 2012.

# Who should be on the Authors' list

## A Report

A report documents in detail the work done including results for a project and has a lead author and other multiple authors

## A Technical Paper

- It highlights one or more aspects of a report
- Multiple papers can come out of one report
- Include any and all who have contributed to the writing of the paper
- Others can be acknowledged

# Ethics

## Ethics

# Types of misconduct

### Conflict of Interest

- A financial or other relationship with the publication at odds with the unbiased presentation of data or analysis.

### Plagiarism

- Copying another person's work word for word or paraphrasing without proper citation.

### Missing Author Attribution

- Must be given if you use another author's ideas in your article, even if you do not directly quote a source.



## Ethics

# Ethical publishing

### Plagiarism

- Avoid plagiarism
  - Cite and separate any verbatim copied material – **but how much?**
  - Paraphrase other's text properly, and include citation
  - Credit any ideas from other sources
  - Familiarize yourself with IEEE Policies



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## Ethics

# Ethical publishing

### Duplication, Redundancies & Multiple Submissions

- Author must submit original work that:
  - Has not appeared elsewhere for publication
  - Is not under review for another refereed publication
  - Cites previous work
  - Indicates how it differs from the previously published work
  - Authors MUST also **inform the editor** when submitting any previously published work



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# Open Access Publications

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- Will start publishing articles from January 2020
- Existing OA Journal of Power and Energy Technology Systems will be rebranded with this **new name**, scope covering the entire field of PES for both practice-oriented and academic articles
- Article processing charge subsidised at **US\$1350**
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Systematic and objective

## Impact Factor is not necessarily enough of a metric

Other attributes:

- Journal's reputation in the community is important
- For new and lesser known journals – look at the editorial board, their reputation

## **Other ways of judging a journal's value to the engineering community**

- 1. Number of Downloads** (IEEE uses this information for revenue distribution)
- 2. Patent Citations** (Available from IEEE)

# Follow-up Steps

## Process of Writing the Paper

Discuss the content among team members  
Literature search – Reference List  
Description of the Experiment/Model  
Results/Discussion  
Write the Conclusion  
Collect the components – Prepare the draft  
All members comment on the draft  
Produce the final copy

## I would like to see a broader IEEE

We need to ensure that we are “READY FOR RECOVERY”, when we get back to the “NEW NORMAL” after COVID-19. Let us enhance cooperation, collaboration and community spirit.

For this we need to make IEEE broader so that IEEE is more relevant to the work our members do regardless where they work.

We need more participation from volunteers globally in IEEE governance. A broader based IEEE will make the Institute more relevant to technologists and academics from all parts of the world.

I would like to see more **IEEE Senior Members** and **IEEE Fellows** from Regions 8, 9 & 10



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Past-Chair, IEEE Publication Services & Products Board

PES accomplishments:

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PES Corporate Engagement Program

PES Chapters' Councils in China, India, Africa and Latin America

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