Publishing Your Research

Chris Winstead

Department of Electrical and Computer Engineering
Utah State University

November 18, 2014

What is the point of graduate school?

There are two types of program:

- Academic – MS and Ph.D., thesis based
- Professional – ME, course/experienced based

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What is the point of graduate school?

The MS Plan A and Ph.D. degrees prepare you for careers in R&D and advanced engineering design.

You demonstrate research and design ability by producing an original thesis.

You demonstrate the academic quality of your thesis if your work is able to pass peer review leading to publication.

From our perspective, we expect you to become junior colleagues in our research teams, producing work that has publishable value.

What is the point of graduate school?

The thesis or dissertation is a report of original research contributions, which may include the following:

- Problem statement with supporting literature.
- Literature Review describing previous solutions to the problem.
- Description of your novel contribution.
- Demonstration that your solution works – you have to prove it!
- Ideas for future research that may be built upon your contributions.

Published articles include the same information, in a more compact format!

Getting Started: Key Questions

1. What is your research area?
2. What are the key conferences and journals in that area?
3. What are the hot topics in those conferences and journals?
4. Who are the major individuals and groups working on your topic?
5. What are the most important papers related to your topic?

You need to know this even if your professor has assigned you some topic to work on. You need to understand what is going on in your field, and you need to explain how your work fits in with the existing literature.

Becoming a Junior Colleague

- Be aware of recent activity in your area.
- Develop a technical understanding of major problems solutions in your area.
- Form opinions about the quality of work seen in different papers.
- Engage in technical conversations with your peers and professors.
- Develop a habit of original thinking.
- Advocate your ideas by offering presentations to your peers and professors.
- Advance your ideas (and your career) by writing articles.
- When your work is mature, compose an article for journal publication.

Your Major Professor

Your major professor is your advisor. Each professor has their own style. Some will closely direct your work, others will expect you to be mostly independent.
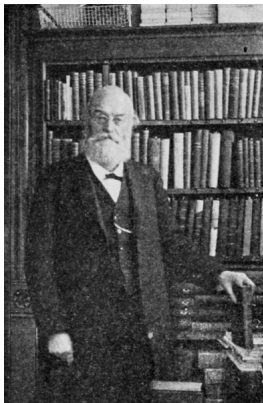

Image Source: Popular Science Monthly no. 77 (public domain).

Think of Yourself as a Writer

By focusing on publishing papers, your thesis is automatically written! You can basically transfer results from your articles into a thesis document.

Make writing a habit. It will lead your research and design efforts.

Image credit: Theodore Marceau, (1859–1922) (public domain)

Conferences I

The most important thing you can do as a grad student is to present your work at a major conference.

Photo by David Toribio

Conferences II

Key Questions:

1. How would you rank the conferences in your topic area?
2. When are the paper submission deadlines for each conference?
3. What is the scope of work typically presented at these conferences?
4. Is there a suitable problem you can tackle in time for the deadline?

Example Conference Ranking

This rank comes from the Big List of VLSI, Signal Processing, etc. Conferences, Journals, Magazines hosted at UC Davis. (Some of the submission dates are not updated, but the list is actively maintained).

Watch Out!

There are low-quality conferences and outright scams in the publishing world. Be careful! Avoid these:

- WSEAS
- WMSCI
- CCCT
- IMETI
- … and many others

Sadly, there are lots of junk conferences (maybe hundreds!), and many of them seem to be setup by the same shady individuals (watch out for a guy named Nagib Callaos who organizes many sham events around Orlando, Florida).

Stick to the well-known venues!

Presentations and Posters I

When your conference paper is accepted, you will be expected to attend the conference and present your results. There are generally two classes of accepted papers:

- Oral presentation — preferred
- Poster presentation — still good, but lower tier

Some conferences also have long and short presentation options. These are decided by the reviewers and editors based on the perceived quality of your work.

Presentations and Posters II

When preparing slides or posters, seek help! Practice your delivery in front of an audience, and complete your presentation materials weeks before the event so you are well prepared.

Photo by David Toribio

Journals

Journals are very important, as they represent a greater stage of completion compared to conference articles.
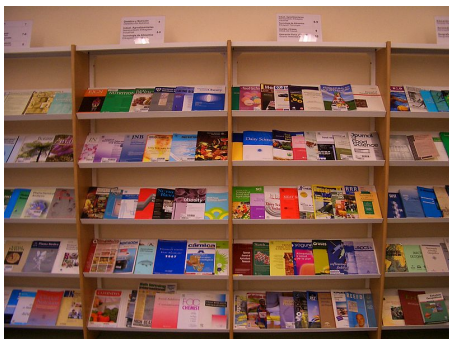
Image credit: Wikipedia user Vmenkov

Transitioning from Conferences to Journals

Usually journal articles come after conference articles.

Transitioning conference articles into journal submissions:

- You can replicate some material from your conference article (copy/paste).
- You must cite the original conference article.
- You must add at least 30% new results.
- You must clearly explain what new results are added, compared to your previous conference article.

The Submission Process

Peer review is a serious scientific process. Make sure your paper is nearly perfect before submitting!

Make sure all co-authors sign off before submitting!

Make sure everyone who contributed is listed as a co-author!

Most papers are submitted via web interfaces. You just create an account and upload your paper. Then the review process begins...

Review and Revision

The review and revision process:

- It may take several months to receive reviews.
- You will get detailed criticism from multiple reviewers.
- They may be wrong about everything, but nevertheless...
- You have to carefully and politely answer each point of criticism, and modify your paper to satisfy reviewer complaints.
- You may need to add new work to the article, or redo some of the work if the reviewers don't like your method.
- Finally, you resubmit your revised article, along with a point-by-point answer to each reviewer critique.
- The process cycles through once or twice more...

Dealing with Rejection

In publishing, persistence pays off. If your work is correct and novel, it can be published with sustained effort. Listen to the reviews, make improvements, try again. Everyone experiences rejection. Dust yourself off and keep going.
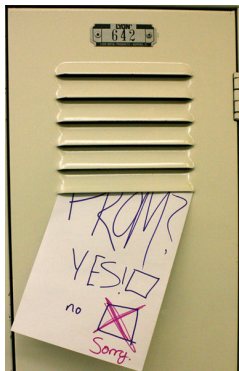
←— (This image is public domain.)
Image source: Wikipedia user Mjt16 ←— (I cited it anyway.)

The Parts of a Paper

Most IEEE papers follow this rough organization:

1. Abstract
2. Introduction
3. Analysis/Design
4. Results (Simulation or Physical)
5. Conclusions

An Example Paper

This paper won best paper award in Communication Theory, IEEE GlobeCom, 2013.

Average Fade Duration for Amplify-and-Forward Relay Networks in Log-Normal Fading

F. Javier Lopez-Martinez, Ernest Kurniawan, Andrea Goldsmith
Wireless Systems Lab, Electrical Engineering
Stanford University, Stanford, CA
Email: {fjlm,ernestkr}@stanford.edu, andrea@wsl.stanford.edu

Abstract—We analyze the level crossing rate and the average fade duration of multihop amplify-and-forward relay networks. We obtain exact closed-form expressions for these statistics when the individual links are affected by log-normal fading with arbitrary autocorrelation. Using this analytical framework we characterize the dynamics of the equivalent multihop channel gain for different correlation models, and study the influence of sampling time, the number of hops and the relay mobility in the investigated scenarios.

I. INTRODUCTION

Second order statistics are useful to characterize the dynamics of the random process associated with fading in wireless communication systems, thus complementing the characterization given by the probability density function (PDF) and the cumulative distribution function (CDF). Two examples of such statistics are the level crossing rate (LCR), which quantifies how often a random process crosses a certain threshold, and the average fade duration (AFD), which determines how long the random process remain below this threshold. Although these statistics have been studied in depth [1–3] for point-to-point communication links, there are few results available for these dynamics in the context of multihop communications.

fading envelope is related to the product of $M+1$ single-hop fading amplitudes.

Most results concerning the second order statistics of multihop fading channels focus on the dual-hop scenario [6–8], due to its mathematical tractability. For the general case of AF-FG multihop relay networks, there only exist results for the LCR and the AFD for the cascaded Rayleigh channel [9]. Although relevant, the exact results in [9] for the LCR are given in terms of an M−fold integral, thus becoming computationally difficult as the number of relays is increased. To circumvent this issue, approximate expressions are also provided in [9] for the LCR and the AFD. To the best of our knowledge, the second order statistics of cascaded fading channels is an open problem for fading distributions other than Rayleigh.

Supported by empirical measurements, the log-normal distribution is widely used to model shadowing for both indoor and outdoor environments [10], small-scale fading phenomena in indoor scenarios and on-body communication channels [2], as well as in the context of cooperative multihop communications [11]. The log-normal distribution is also used to approximate the product of positive random variables [12, 13], so it

Abstract

The abstract should be a brief synopsis of the article's contents:

Abstract—We analyze the level crossing rate and the average fade duration of multihop amplify-and-forward relay networks. We obtain exact closed-form expressions for these statistics when the individual links are affected by log-normal fading with arbitrary autocorrelation. Using this analytical framework we characterize the dynamics of the equivalent multihop channel gain for different correlation models, and study the influence of sampling time, the number of hops and the relay mobility in the investigated scenarios.

Introduction I

The introduction should provide background and motivation:

I.   INTRODUCTION

Second order statistics are useful to characterize the dynamics of the random process associated with fading in wireless communication systems, thus complementing the characterization given by the probability density function (PDF) and the cumulative distribution function (CDF). Two examples of such statistics are the level crossing rate (LCR), which quantifies how often a random process crosses a certain threshold, and the average fade duration (AFD), which determines how long the random process remain below this threshold. Although these statistics have been studied in depth [1–3] for point-to-point communication links, there are few results available for these dynamics in the context of multihop communications.

One of the simplest models in multihop communications is

Introduction II

It should also establish your paper's novelty:

Most results concerning the second order statistics of multihop fading channels focus on the dual-hop scenario [6–8], due to its mathematical tractability. For the general case of AF-FG multihop relay networks, there only exist results for the LCR and the AFD for the cascaded Rayleigh channel [9]. Although relevant, the exact results in [9] for the LCR are given in terms of an $M-$fold integral, thus becoming computationally difficult as the number of relays is increased. To circumvent this issue, approximate expressions are also provided in [9] for the LCR and the AFD. To the best of our knowledge, the second order statistics of cascaded fading channels is an open problem for fading distributions other than Rayleigh.

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Introduction III

After describing state-of-the-art knowledge on the topic, the introduction should give a statement of contributions like this one:

In this paper, we investigate the second order statistics of non-regenerative fixed-gain multihop relay networks affected by log-normal fading. We derive exact closed-form expressions for the LCR and the AFD of the continuous envelope fading in this scenario, assuming a twice-differentiable correlation profile and an arbitrary number of relay stations. Then, we extend these results considering a finite sampling period T_S and an arbitrary correlation. We use the derived expressions to analyze the effect of the number of relay stations on the dynamics of the equivalent gain, as well as to illustrate how the mobility of a subset of relay stations has an impact on the second order statistics.

Introduction IV

At the end of the introduction, a statement of organization is expected:

> The remainder of this paper is structured as follows: in Section II the system model for non-regenerative fixed-gain multihop relay networks is introduced. Second order statistics in this scenario are calculated in Section III, whereas numerical results and discussion are tackled in Section IV. Finally, our main conclusions are presented in Section V.

Notation, Models, Analysis, Designs

After the introduction, the paper should clearly state notation, provide detailed descriptions of models and assumptions, and give precise derivations for any new mathematical results.

II. System Model

A. Notation and preliminaries

In the following, we use $E\{\cdot\}$ to denote the expectation operation, and $|\cdot|$ to indicate the modulus of a complex number. The symbol $\sim$ means *statistically distributed as*, whereas the notation $\mathcal{N}(\mu, \Omega)$ represents a normal distribution with mean μ and variance Ω. The symbol $\lceil\cdot\rceil$ denotes the ceiling function.

B. Multi-hop network system model

Let us consider the scenario depicted in Fig. 1, where the communication between a source node S and a destination node D separated by a distance d occurs with the assistance of a set of M intermediate relay stations denoted as R_i, $i = 1 \dots M$.
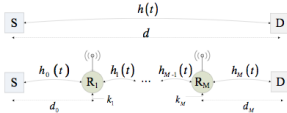

Fig. 1. Direct vs. relay assisted communication between S and D.

These intermediate nodes amplify and forward the received signal using a fixed gain k_i given by

where $g_i = h_i^2$. In the investigated scenario, we assume as in [11] that the random processes $g_i(t)$, $\{i = 0 \dots M\}$ are independent but non-identically distributed log-normal processes; i.e., the processes given by $x_i(t) = 10 \log_{10}[g_i(t)]$ follow a normal distribution $x_i(t) \sim \mathcal{N}(\mu_i, \Omega_i)$. Therefore, the marginal PDF of the process g_i is expressed as

$$f_{g_i}(g) = \frac{\xi}{g\sqrt{2\pi\Omega_i}} e^{\frac{[10\log_{10}(g)-\mu_i]^2}{2\Omega_i}}, \qquad (6)$$

where $g > 0$ and $\xi = 10/\ln 10$.

We consider the path loss model [16], where the signal to noise ratio (SNR) of two individual links are related through the path loss exponent α as follows

$$10 \log_{10}(P_{tx}/P_{rx}) = L_{d0} + 10\alpha \log_{10}(d/d_0) + \chi \qquad (7)$$

where L_{d0} is the path loss at reference distance d_0, α is the path loss exponent, and χ is the log-normal random fading component with zero mean and Ω variance.

We fix the distance from the source S to the destination D to be d, and then consider that two consecutive nodes are separated by a distance d_i so that $\sum_{i=0}^{M} d_i \geq d$, where the equality holds if the relays are located in the $S - D$ line. If the relays are equispaced, then $d_i = \frac{d}{M+1}$.

III. Second Order Statistics in Multihop Networks

In this section, we calculate the LCR and the AFD of the equivalent channel gain at the destination in an AF-FG multihop relay network affected by log-normal fading. First

Results

Quantitative results should be placed in their own section, after the analysis. The paper should provide discussion of the results, which includes interpretations, explanations and assessment of theory vs observations.

which is coincident with (14). In those cases where $\tilde{p}$ is not defined at the origin, it can be shown that $\lim_{T_s \to 0}$ in (19) tends to infinity. Hence, the LCR of the sampled random process is unbounded for arbitrarily small T_s.

IV. NUMERICAL RESULTS AND DISCUSSION

In this section, we illustrate the applicability of the derived expressions in a number of scenarios of interest. We assume that the relay stations are equispaced along the line between the source and destination. We also consider that the fixed gains[1] k_i at the relays are calculated in order to compensate the effect of path loss in every hop according to (7); hence, as the number of relays is increased, the path loss attenuation and the required gains at the relays are reduced. We also consider a path loss exponent $\alpha = 3.5$ and a log-normal variance $\Omega_i = 6$ dB.

Fig. 2 shows the LCR of the equivalent channel gain in an AF-FG multihop relay network for different numbers of hops. Two different correlation models have been considered: a Bessel-like correlation model [2] with $\rho(T) = J_0(2\pi T f_d)$, and an exponential correlation model [19] with $\rho(T) = \exp{-T/\tau}$, where τ is the decorrelation time, or equivalently $\rho(d) = \exp{-d/\Delta}$, where Δ is the decorrelation distance[2]. We have considered $f_d = 10$, $\tau_0 = 10^{-3}$ and $T_s = 10^{-4}$, and the normalized LCR is defined
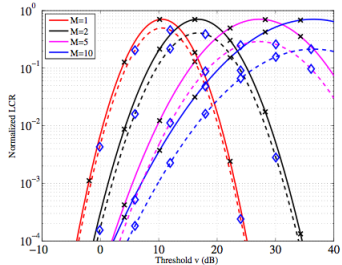

Fig. 2. Normalized LCR vs threshold level v for different numbers of relays M. Solid plots and dashed lines correspond to the correlation models [2] and [19], respectively. MC simulations (markers). Parameter values are $\Omega_i = 6$ dB, $\alpha = 3.5$, $f_d = 10$ Hz, $\tau_0 = 10$ ms, and $T_s = 0.1$ ms.

Analogously, the AFD of the equivalent channel gain is depicted in Fig. 3, in the same scenarios considered in the previous figure. In this case, the normalized AFD is defined

Conclusions

The conclusions should offer a summary of major findings. It is also common to speculate about how the research may be continued, extended or applied to other problems.

V. CONCLUSION

The second order statistics of the equivalent channel gain in AF-FG multihop relay networks affected by log-normal fading have been derived. It is observed that the threshold value that yields a maximum number of crossings is increased with the number of relays M. For a given threshold value, the number of crossings (and hence the duration of fades) is showed to depend on the number of hops and on the relay mobility.

This analysis can be extended to other scenarios: (1) the product of correlated log-normal RVs is also log-normal, so the effect of correlation between hops could also be analyzed; (2) the product of positive RVs can be approximated as log-normal [12, 13], and hence our framework can be used to approximate the second order statistics for other fading distributions.

Acknowledgments

If you or your co-author(s) are supported by any official grant or fellowship, it should be explicitly noted in the paper. This is commonly placed in a footnote on the front page, or in a separate section titled "Acknowledgments." Conferences and journals usually provide an author guide that specifies where to place this information.

Matters of Style

Every journal and conference has author guidelines, and may recommend a specific style reference (like Strunk and White's The Elements of Style or the Chicago Manual of Style). Study the guidelines carefully.

Define acronyms on first use, e.g. SNR (Signal to Noise Ratio).

Typically, all equations are numbered. When referring to an equation, say "substituting into (10)" instead of "substituting into Equation (10)".

In IEEE publications, refer to figures as "Fig. 1", not "Figure 1" or "fig. 1".

Bibliography styles are precisely defined by IEEE. Follow the guidelines.

Ethics

All academic publications should conform to a few basic rules:

- Transparency
  - Who funded the work?
  - Who did the work?
  - What are the novel contributions?
- Integrity and Misconduct
  - Has the work been published before?
  - Has data been fabricated or manipulated (including cosmetic alterations)?
  - Does the study include human or animal subjects?
    If so, was there appropriate institutional review?

Make sure you take the RGS course on Research Integrity!

Plagiarism I

Plagiarism rules are different from copyright laws. "Fair use" allows you to borrow figures or text under certain circumstances. Plagiarism is a more restrictive concept.

Credit: Mimi and Eunice by Nina Paley

Plagiarism II

What is plagiarism?

- Copy + Paste = Plagiarism.
- Copy + Paste + Modification = Plagiarism.
- Screenshots = Plagiarism.
- False claims of originality = Plagiarism.
- Re-publishing your own work = Self-Plagiarism.

Plagiarism III

How to avoid plagiarism?

- Cite every source you use!
- Never copy and paste.
- Your writing should include only brief summary of previous authors' work. You do not need to repeat all the details. Your article/thesis is not a textbook; it should focus on novel contributions.
- Provide only the technical background that is absolutely necessary to explain your problem, to describe your solution, and to justify your results.
- For complex background material, you may cite textbooks or tutorial articles to assist readers who may be unfamiliar with the content. You don't need to explain everything.

Plagiarism IV

But I have a philosophy!

Image source: Wikipedia

You need to follow the community norms regardless of your personal attitude. There is a genuine debate happening about the nature of copying and plagiarism. You may join that debate if you want, but until there's a widespread consensus for change, we still have to comply with all stated policies.

Sharing Your Work

Most journals and conferences offer an electronic posting policy allowing you to post your manuscript on personal web pages or institutional archives (see this FAQ from IEEE). Check the policy!

Many journals now offer an Open Access option for a fee. Research grants may support Open Access publication fees; check with your adviser. The USU Library has a program to offset Open Access costs, so check into it.

If allowed by the journal's policy, you may post your article the arXiv repository and to USU's Digital Commons. These are good ways to get early readers for your work.

Image Credit: PLoS

Scholarly Sources I

In your article/thesis, only cite from scholarly sources like these:

- Published journal articles (best).
- Published conference articles (less best).
- Research monographs (books).
- Textbooks (acceptable for citing general knowledge).

Scholarly Sources II

The following sources are not considered suitable for academic citation:

- Encyclopaedias
- Wikipedia
- Newspapers or magazines
- Web pages
- Miscellaneous documents and tech. reports.

Writing Quality Documents

Learn LaTeX — There are many good references, like the TeX Wikibook. Study it. Practice it.

There are many good LaTeX distributions and editors. I recommend TexLive.

See Dr. Budge about obtaining our latest LaTeX thesis template. Study it. Imitate it.

Obtain Michael Shell's guide to using the IEEETran document class. It comes with a template. You can also obtain original documents from peers or advisers to see detailed examples.

For slide presentations and posters, check out the Beamer document class. It has gained wide popularity in academic conferences.

Producing Quality Figures

Avoid bitmapped graphics:

- BMP
- PNG
- JPEG
- GIF

If you use these formats, make sure you don't distort the aspect ratio! Also make sure the figure is readable! Print out your document and make sure it doesn't look like garbage.
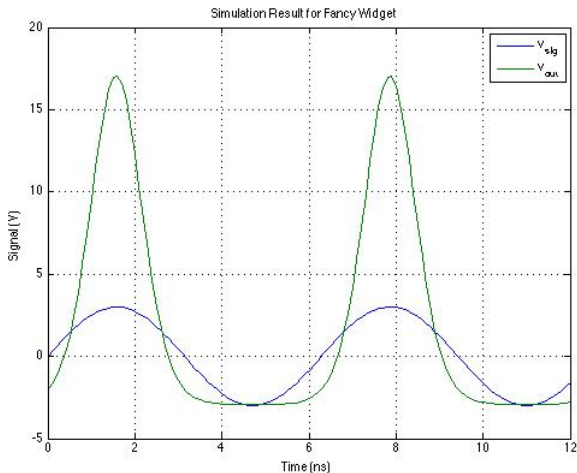
Preferably, use vector graphics:

- PDF figures
- EPS figures

You can produce vector graphics using drawing software like Inkscape or Xfig. You can also produce graphics directly within LaTeX documents by using packages like TikZ and pgfplots. Try it!
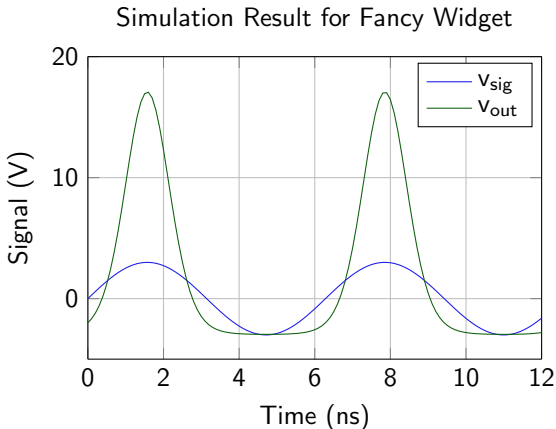
Example: JPG from Matlab

This looks like garbage.

Example Using PGFplots

PGFplots is able to produce nice plots directly within LaTeX. This makes it easy to modify figures later on.

Simulation Result for Fancy Widget

Matlab to PGFplots

There's a downloadable script called Matlab2Tikz that translates Matlab plots directly into a PGFplots figure.

You can import the figure directly into a LaTeX document.

There's no excuse for not using it!

In Conclusion...

Thanks for listening

Good Luck!