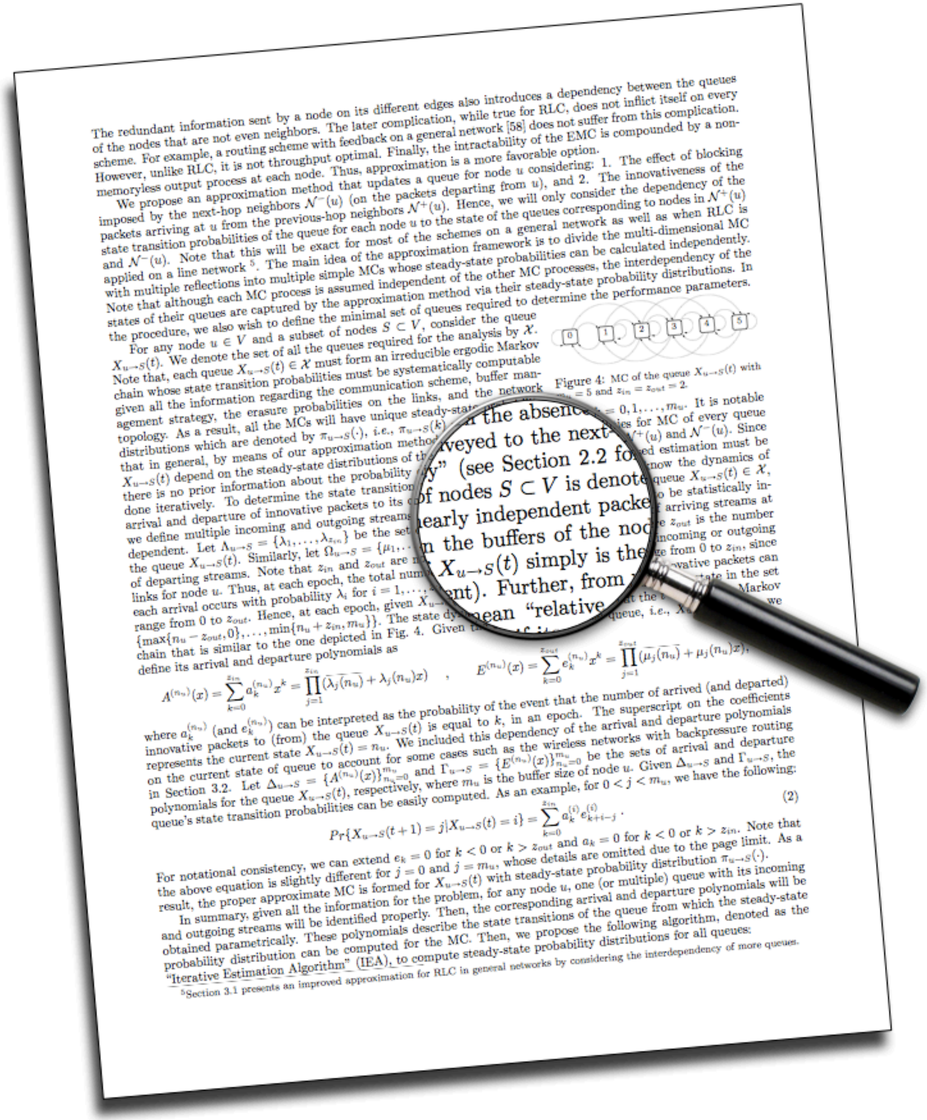
Top Ten Mistakes to Avoid in Writing CAREER Proposals


Number 10: Fonts Too Small

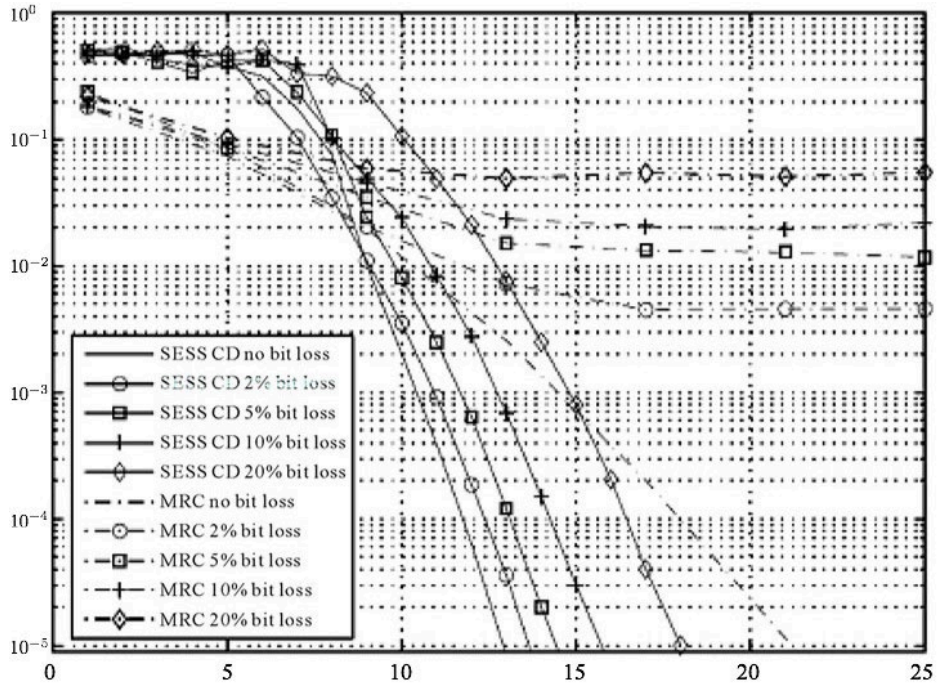
- Small fonts promote reader fatigue
- Reviewers DISLIKE small fonts
- PAPPG mandates:
  - 11 point font minimum
  - 1 inch margins
  - 6 lines max per vertical inch

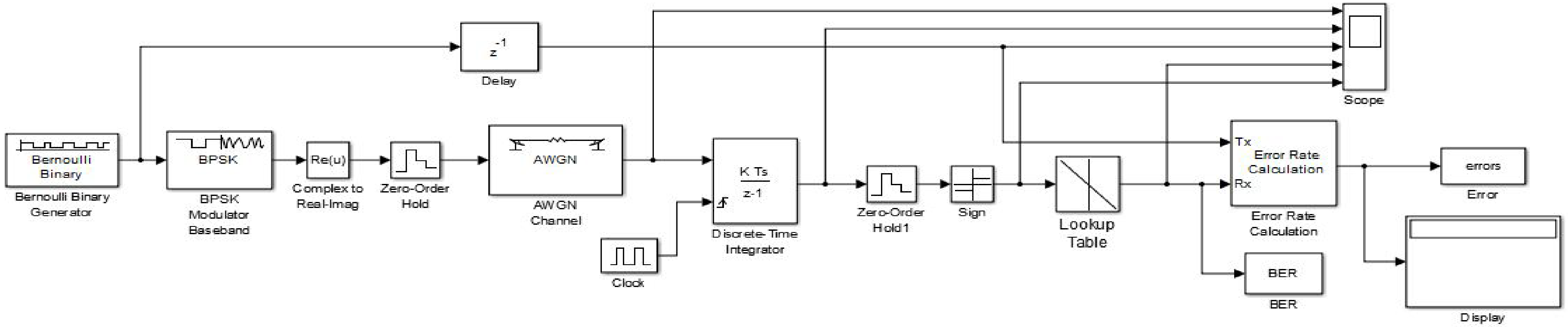


See: https://github.com/nsf-open/nsf-proposal-latex-samples

Number 9: Figures Illegible

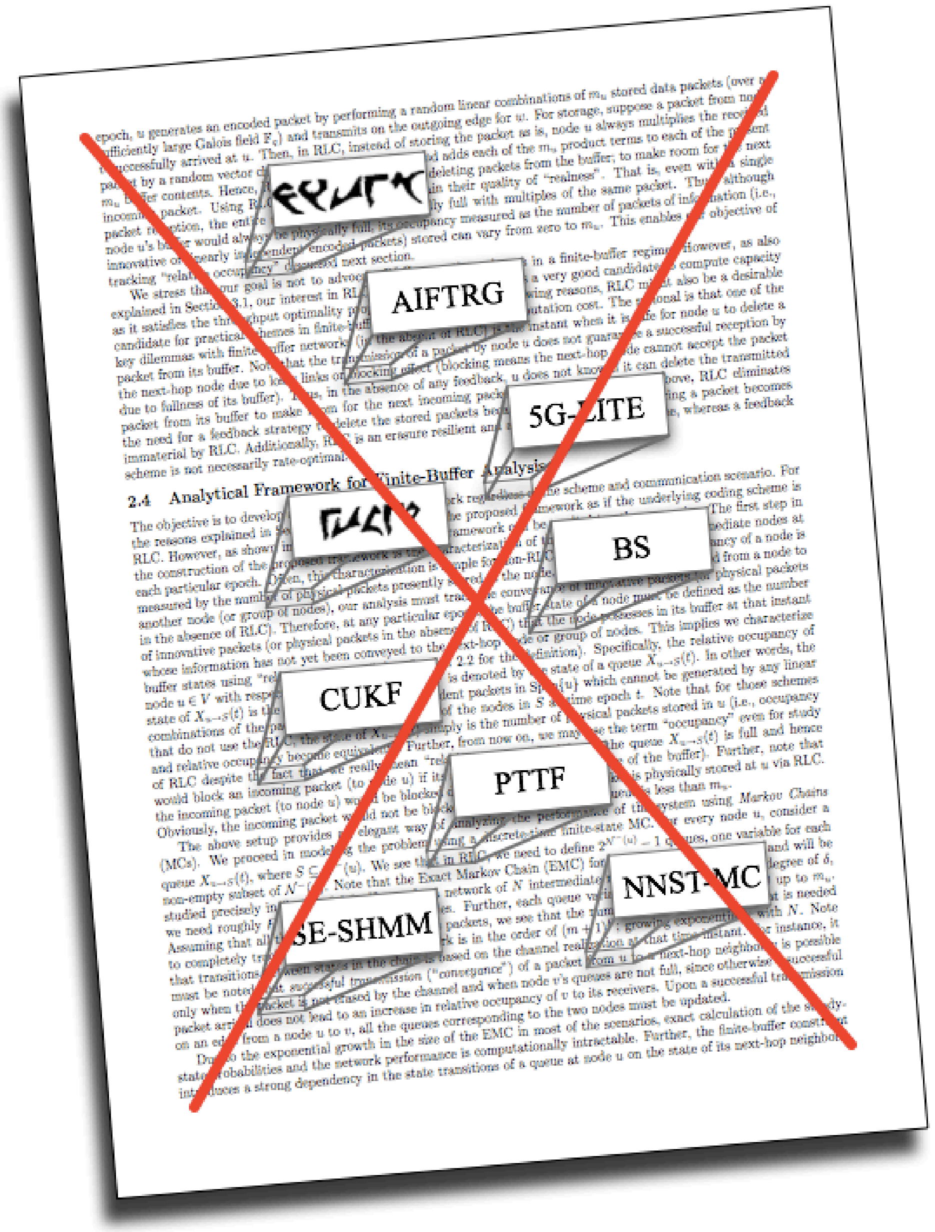
- Avoid “crowded” visuals
- Don’t assume reader will print in color
- Use vector graphic formats





Number 8: Acronyms and Abbreviations

- Acronyms constitute a **private language** that excludes the reader.
- Abbreviations are often **cryptic**, and make text hard to read.
- Reader will NOT memorize your abbreviations!



Number 7: Dissing the Competition

- Good idea: Citing others' work
- Bad idea: Slighting others' work

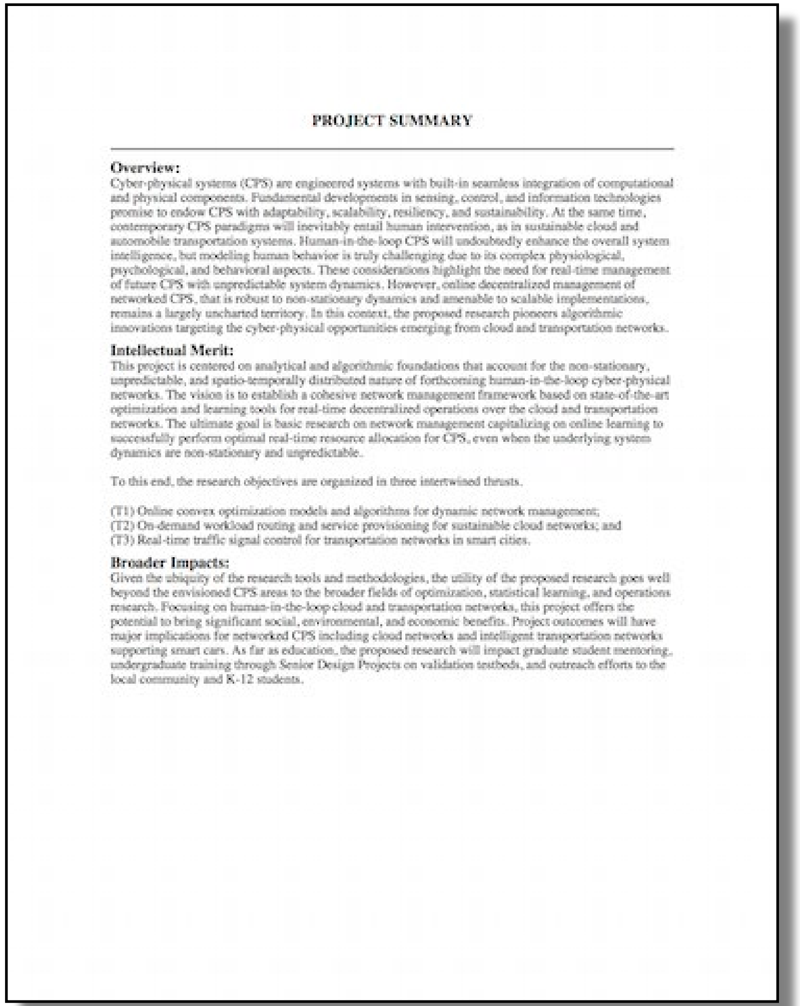


("Others' work" might be sitting on the panel)

Number 6: Poor distinction between preliminary results and proposed work

- Make a clear demarcation
- Distinguish your results from others’
- Set clear objectives
- Identify obstacles you anticipate
- Highlight what you bring to the table
- Include a validation plan

Number 5: Misleading Project Summary



PROJECT SUMMARY

Overview:
Cyber-physical systems (CPS) are engineered systems with built-in seamless integration of computational and physical components. Fundamental developments in sensing, control, and information technologies promise to endow CPS with adaptability, scalability, resiliency, and sustainability. At the same time, contemporary CPS paradigms will inevitably entail human intervention, as in sustainable cloud and automobile transportation systems. Human-in-the-loop CPS will undoubtedly enhance the overall system intelligence, but modeling human behavior is truly challenging due to its complex physiological, psychological, and behavioral aspects. These considerations highlight the need for real-time management of future CPS with unpredictable system dynamics. However, online decentralized management of networked CPS, that is robust to non-stationary dynamics and amenable to scalable implementations, remains a largely uncharted territory. In this context, the proposed research pioneers algorithmic innovations targeting the cyber-physical opportunities emerging from cloud and transportation networks.

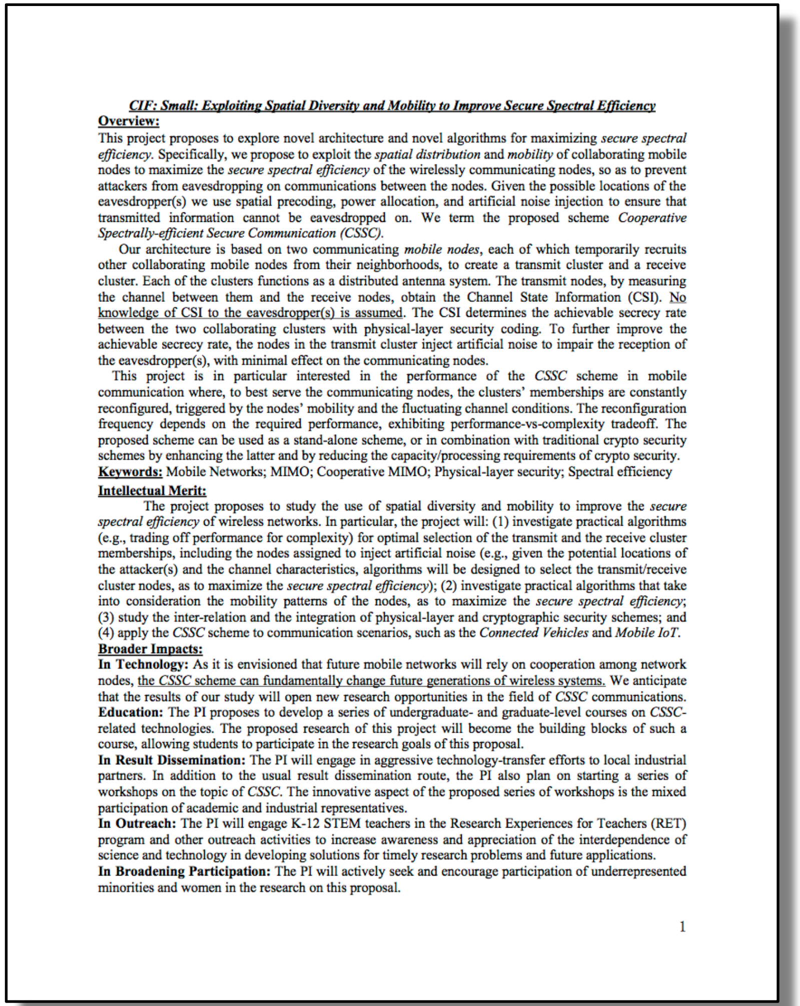
Intellectual Merit:
This project is centered on analytical and algorithmic foundations that account for the non-stationary, unpredictable, and spatio-temporally distributed nature of forthcoming human-in-the-loop cyber-physical networks. The vision is to establish a cohesive network management framework based on state-of-the-art optimization and learning tools for real-time decentralized operations over the cloud and transportation networks. The ultimate goal is basic research on network management capitalizing on online learning to successfully perform optimal real-time resource allocation for CPS, even when the underlying system dynamics are non-stationary and unpredictable.

To this end, the research objectives are organized in three intertwined thrusts.

(T1) Online convex optimization models and algorithms for dynamic network management;
(T2) On-demand workload routing and service provisioning for sustainable cloud networks; and
(T3) Real-time traffic signal control for transportation networks in smart cities.

Broader Impacts:
Given the ubiquity of the research tools and methodologies, the utility of the proposed research goes well beyond the envisioned CPS areas to the broader fields of optimization, statistical learning, and operations research. Focusing on human-in-the-loop cloud and transportation networks, this project offers the potential to bring significant social, environmental, and economic benefits. Project outcomes will have major implications for networked CPS including cloud networks and intelligent transportation networks supporting smart cars. As far as education, the proposed research will impact graduate student mentoring, undergraduate training through Senior Design Projects on validation testbeds, and outreach efforts to the local community and K-12 students.

Good



CIF: Small: Exploiting Spatial Diversity and Mobility to Improve Secure Spectral Efficiency

Overview:
This project proposes to explore novel architecture and novel algorithms for maximizing *secure spectral efficiency*. Specifically, we propose to exploit the *spatial distribution* and *mobility* of collaborating mobile nodes to maximize the *secure spectral efficiency* of the wirelessly communicating nodes, so as to prevent attackers from eavesdropping on communications between the nodes. Given the possible locations of the eavesdropper(s) we use spatial precoding, power allocation, and artificial noise injection to ensure that transmitted information cannot be eavesdropped on. We term the proposed scheme *Cooperative Spectrally-efficient Secure Communication (CSSC).*

Our architecture is based on two communicating *mobile nodes*, each of which temporarily recruits other collaborating mobile nodes from their neighborhoods, to create a transmit cluster and a receive cluster. Each of the clusters functions as a distributed antenna system. The transmit nodes, by measuring the channel between them and the receive nodes, obtain the Channel State Information (CSI). No knowledge of CSI to the eavesdropper(s) is assumed. The CSI determines the achievable secrecy rate between the two collaborating clusters with physical-layer security coding. To further improve the achievable secrecy rate, the nodes in the transmit cluster inject artificial noise to impair the reception of the eavesdropper(s), with minimal effect on the communicating nodes.

This project is in particular interested in the performance of the *CSSC* scheme in mobile communication where, to best serve the communicating nodes, the clusters' memberships are constantly reconfigured, triggered by the nodes' mobility and the fluctuating channel conditions. The reconfiguration frequency depends on the required performance, exhibiting performance-vs-complexity tradeoff. The proposed scheme can be used as a stand-alone scheme, or in combination with traditional crypto security schemes by enhancing the latter and by reducing the capacity/processing requirements of crypto security.

Keywords: Mobile Networks; MIMO; Cooperative MIMO; Physical-layer security; Spectral efficiency

Intellectual Merit:
The project proposes to study the use of spatial diversity and mobility to improve the *secure spectral efficiency* of wireless networks. In particular, the project will: (1) investigate practical algorithms (e.g., trading off performance for complexity) for optimal selection of the transmit and the receive cluster memberships, including the nodes assigned to inject artificial noise (e.g., given the potential locations of the attacker(s) and the channel characteristics, algorithms will be designed to select the transmit/receive cluster nodes, as to maximize the *secure spectral efficiency*); (2) investigate practical algorithms that take into consideration the mobility patterns of the nodes, as to maximize the *secure spectral efficiency*; (3) study the inter-relation and the integration of physical-layer and cryptographic security schemes; and (4) apply the *CSSC* scheme to communication scenarios, such as the *Connected Vehicles* and *Mobile IoT*.

Broader Impacts:
In Technology: As it is envisioned that future mobile networks will rely on cooperation among network nodes, the *CSSC* scheme can fundamentally change future generations of wireless systems. We anticipate that the results of our study will open new research opportunities in the field of *CSSC* communications.
Education: The PI proposes to develop a series of undergraduate- and graduate-level courses on *CSSC*-related technologies. The proposed research of this project will become the building blocks of such a course, allowing students to participate in the research goals of this proposal.
In Result Dissemination: The PI will engage in aggressive technology-transfer efforts to local industrial partners. In addition to the usual result dissemination route, the PI also plan on starting a series of workshops on the topic of *CSSC*. The innovative aspect of the proposed series of workshops is the mixed participation of academic and industrial representatives.
In Outreach: The PI will engage K-12 STEM teachers in the Research Experiences for Teachers (RET) program and other outreach activities to increase awareness and appreciation of the interdependence of science and technology in developing solutions for timely research problems and future applications.
In Broadening Participation: The PI will actively seek and encourage participation of underrepresented minorities and women in the research on this proposal.

1

Fair

Number 4: “It wasn’t clear …”

Symptoms:

- Long-winded explanations
- Too many superfluous details
- Poor organization of thoughts into words

Remedies:

- Use fewer words
- Read first two pages aloud
- “Make every word tell”

Number 3: Lackluster Education Plan

- Should be integrated with research plan
- Think **beyond** your present teaching duties



Number 2: Confining yourself to your PhD work

- CAREER proposal should be forward-looking
- Move above and beyond your PhD work
- “Imagine a world …”

(yes)

(no)

Number 1: Research Plan lacking Cohesion

- Don’t staple together unrelated ideas

- Don’t offer a laundry list with no prioritization

- Don’t make everything look like a nail to your one hammer

- Tell a story with your narrative

Questions?