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# Technical Abstracts

## CRAFTING EFFECTIVE, PRECISE ABSTRACTS FOR YOUR TECHNICAL PAPER

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I personally find it difficult to begin writing papers, especially those with open-ended topics. While choosing a major, the apparent lack of writing requirements in technical disciplines definitely factored into my decision.

That said, I soon found that clear writing was an essential skill, even in fields like my major—Mechanical Engineering. Despite being intimidated at first, I've found that the technical writing required in engineering is, in a way, more structured and easier to compose than that in other disciplines. A key element of such writing is the abstract. With the right strategies, writing a clear abstract can be far easier than you'd expect...

### The Purpose of an Abstract:

Abstracts are a genre largely unique to academic writing. While sometimes thought of as similar to introductions, they actually fulfill a different role. The abstract can serve several purposes, but its primary use is to enable readers to select relevant works for research. Most abstracts offer a condensed summary of a longer work (sometimes already finished and sometimes to-be-done) that audiences examine to determine the relevance of that research to their own projects.

### Two Primary Categories:

#### Descriptive Abstracts

- Exist in a variety of disciplines
- Describe research to be performed rather than results
- Drafted early in the research process
- Respond to a call for proposals
- Focus on clearly defining the relevance and scope of a project

#### Informational Abstracts

- More peculiar to technical disciplines
- Mirror the five-section model (IMRAD)
- Summarize all aspects of a study
- Finalized near the end of a project or study (drafted chronologically)
- Include significant results, limitations, and recommendations of the research

### Elements to Include:

Provide the necessary background to your field (are you writing for a general audience? subject-matter experts?) and clearly define the “gap” in existing research that you hope to fill. Explain how your work or research approaches or solves this problem. In the process, precisely define the scope of your project. Finally, summarize your key results and conclusions; when doing so, maintain scientific integrity by explaining both the implications and limitations of your work.

## Beginning to Write

This guide focuses primarily on informational abstracts, though many concepts are applicable to both types. Clarity and concision are key elements of technical writing. To achieve these qualities in an abstract, it is often helpful to start with a large amount of content and distill it to only the most necessary portions. From personal experience, I've found the 'reverse-outline' a very effective way to achieve this goal. Start by highlighting the most important parts of your paper or report; copy and paste those sentences into your abstract. Keep in mind that repetition of ideas between your abstract and the remainder of your paper is not only acceptable but often necessary. Also, compiling more detail than you'll eventually need will be helpful in the long-run. From here, trim the 'fat' from your abstract: with regard to content, for instance, eliminate any minor conclusions that are not essential to the communication of your primary results. With respect to style, eliminate any phrases that do not contribute directly to your message. If you keep at it, you'll find that you're often able to restate an idea in far fewer words without sacrificing precision or clarity.

## Refining your Work

As you revise your abstract, there are several key points to check. First, ensure that all key terms for your research are identified and their relevance is explained. Not only will this guarantee the completeness of your abstract, but it allows your paper to be better indexed if it is published—which in turn allows future readers to find your paper. Read through your draft repeatedly, sometimes aloud, and confirm that each clause contributes in a concrete way. Again, concision and precision are key. Finally, aim to keep your writing as simple as possible without introducing ambiguity. Eliminate unnecessary technical jargon, avoid redundancy within sections, and strive to write simply. (*One helpful tip:* restrict your most important ideas to the main clause of each sentence. Your primary focus ought to be clear content, not flowing style).

### Let's see how these principles play out in an informational abstract I wrote for a class in Mechanical Engineering:

This project examines the thermomechanical effects of directed energy weapons on a simplified target geometry. **While current models ignore various physical phenomena, this program seeks to establish the relative importance of these individual properties** through a sensitivity analysis consisting of multiple permutations of program facets. Specifically, **the project explores relative effects of temperature-dependent thermophysical properties, changes in surface absorptivity, and the beam profile of incident laser radiation. It also explores various methods and aspects of phase change, to include latent heat accumulation, finite element vaporization, partial mesh fluidization, and latent heat spikes.** The program itself is an iterative MATLAB function employing heat transfer theory along with a comparative transient thermal model created in SolidWorks. **The desired outcome of the study is a robust and flexible model of computational heat transfer on a generalized target, which can accurately predict thermal effects of laser radiation.** The model will then be validated using experimental results from the Photonics Research Center at West Point. If results are verified by this data, **the model can be used to both predict the effects of directed energy weapons systems on actual targets, and optimize laser attributes for specific targets, materials, and ambient conditions.**

### Key Elements

- Identifies a “gap” in the field
- Explains how this project seeks to resolve this gap in knowledge
- Defines the scope of the research
- Lists implications of the work

### Areas for Further Revision

- Several key terms (such as “thermomechanical effects”) are left undefined.
- The approach, “a sensitivity analysis,” is vague and could be improved by listing which variables were adjusted.
- Some of the technical jargon may be unnecessary, depending on the intended audience for the abstract. Eliminating such phrases could increase clarity.

*Strive to be as precise, clear, and concise as possible with your writing—good luck!*