

## Resources

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## Abstract

This document describes a general outline for writing a scientific research paper. Even though this document does not follow the IJCA or IJAIS paper templates, it provides general guidelines to writing a paper or technical document. All the FCS journals maintain their own paper templates which can be downloaded from their respective websites. Usually all the FCS journal articles include the following sections: Abstract, Keywords, Introduction, Related Work, Problem Statement, Solution Approach, Simulation, Analysis of Results, Conclusions, Future Work, Acknowledgement, and References. Some of these sections are optional and can be omitted or combined. In this paper we provide description of each of these sections give some examples.

## Keywords

Scientific paper, Research paper, Document structure, Writing style    **1. Introduction**

The ability to write and to express thoughts in a clear manner is a vital step on the path to becoming a well-rounded and educated person. However, often researchers, academicians and students who study scientific disciplines such as computer science discount this very important skill. This becomes clear when one examines the technical documents written by graduate students. This paper provides some general guidelines to assist graduate students in writing better technical documents and scientific / research papers.

Why should you care about this? Well, presumably you are writing the paper to sell your work in some way. In the context of a class, you are trying to convince your guide or professor that you have done a good job. In the context of a paper you publish at a reputed international journal such as [International Journal of Computer Applications](#) , you want to convince others of exactly the same thing. Write a poor paper and people may dismiss your work out of hand. Write a good paper and you may succeed in publicizing your work to a large audience.

Most scientific / research papers are divided into several sections, such as Abstract, Keywords, Introduction, Related Work, Problem Statement, Solution Approach, Simulation, Analysis of Results, Conclusions, Future Work, Acknowledgement, and References. While the actual section names may differ from those mentioned above, the content of the individual sections should generally match this outline. For example, the *Introduction* will introduce the reader to

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the general issues addressed in the paper, while the

### *Set-Up / Configuration of the Study*

describe how the study of the proposed solution was conducted. To simplify this document, we will use the section names mentioned above.

In the first two paragraphs of this section, we have provided an example of the kinds of information included in the *Introduction*. In the remainder of this section, we will provide a brief description of the *Abstract, Keywords, and Introduction* sections.

The *Abstract* is a short description (e.g. a third of a page) of the problem and proposed solution or approach to the solution presented in the paper. The purpose of the *abstract* is to provide a brief summary of the work that will enable the reader to quickly determine whether he or she wishes to read the rest of the paper. Thus your

### *abstract*

should provide a good overview of the paper, in a way that may entice the reader to keep reading.

The *Keywords* section has a similar purpose: to help those who are searching for work just like yours find your paper.

*Keywords* list (as individual words or short phrases) the particular areas of study that your paper covers, and are often used for electronic searches.

Typically someone finding a set of papers based on keywords will then read the

### *abstracts*

to further narrow the list. FCS journals such as IJCA or IJAIS include the keywords in the advanced search systems for search optimization.

The *Introduction* section is present in almost every scientific document and it is usually about one or two pages long or 5% to 10% of the paper. In this section the authors introduce the problem being addressed in the paper and describe its importance and relevance to the field of study. In addition, at the end of this section the authors often describe the structure of the paper.

The general formatting requirements such as the size, font, spacing, indentation, layout, format of the paper title, section and subsection headings, text on the paper, paragraphs, tables, figures, equations, references, etc. are usually provided by FCS journals in the form of the *paper template*

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. It is critical that authors pay close attention to these requirements. Foundation of Computer Science (FCS) reviewers or editorial board may reject a paper simply because the authors did not follow the formatting instructions.

### 2. Related Work

Generally, the *Related Work* section is placed either immediately after the *Introduction* or at the end of the paper immediately before the *Conclusions*

and

*Future Work*

section. When placed early on, it helps the reader better understand the problem discussed in the paper by briefly introducing a variety of other approaches to solving the problem. When placed near the end, it allows the reader to compare and contrast the proposed solution with other research performed in the field. The

*Related Work*

section is usually present in the majority of research and scientific publications. This section is not very long and generally is limited to not more than three pages or 10% to 20% of the paper.

### 3. Problem Statement

The *Problem Statement* section is also fairly short, generally about one-half to two pages long or 5% to 15 % of the paper. Unlike the *Introduction*, which describes the general problem, this section provides specific details about the problem, often introducing a precise mathematical definition. While there may not be a section titled

*Problem Statement*

, a problem description is a required part of any paper. If the paper does not include the

*Problem Statement*

section then usually the problem description is provided as one or more separate paragraphs or as a sub-section in the

*Introduction*

or in the

*Solution Approach*

sections.

### 4. Solution Approach and Methodology

The *Solution Approach* describes the rationale and the details of the solution to the problem. This section usually takes the main portion of the paper and generally ranges between one and 10 pages, or about 40-50% of the material. This is a mandatory section and generally consists of several logically connected sub-sections. Often one of the subsections in the

*Solution Approach*

describes the methodology of the solution or the steps to solving the problem. The size of the

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### *Methodology*

part of the paper varies depending on the topic and can range anywhere from a single paragraph to several pages.

Whenever the paper describes a study it is important to carefully describe how the study was conducted and what assumptions were made. The rule to writing this section is to include enough details that anyone else who would like to repeat the study can do so based on the description you provide.

The *Analysis of Results* section usually follows the *Set-up / Configuration of the Study or Simulation*.

This section provides a careful analysis of collected results identifying various observed phenomena and highlighting the importance of made observations. The sections that describe the study and analysis of results are very important and usually take several pages, anywhere between 15% and 30% of the paper.

### **5. Conclusions and Future Work**

The *Conclusions* and the *Future Work* sections summarize the paper, draw conclusions about the proposed solution, and chart future directions of the research. These sections are mandatory but usually are not very long, ranging anywhere between one-half a page to 2 pages or 5% to 10% of the paper.

### **6. Acknowledgments**

Occasionally, the authors list people and organizations that helped complete and publish the work. This information usually goes into the *Acknowledgment* section which is only a few lines long.

### **7. References**

The final section of any paper lists the *references* used to do the research and write the paper. There are various standards for compiling the *references*

and listing them in the paper. The authors refer the reader to the web links listed in the *References*

section for further details. However, here are a few key rules:

- There are various formats for citing the references in the text of the paper and listing them

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in the *Reference* section

- Different types of references (e.g. journal, books, conference paper, web-sites) have different formats for citing them in the *Reference* section

- The references are usually ordered either alphabetically or by the order they are mentioned in the text