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Implementing Structured Abstracts in JM^3

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Implementing Structured Abstracts in JM^3

In July 2018, JM^3 began encouraging authors to use structured abstracts in their manuscript submissions. There will be a transition period where both traditional and structured abstracts will be accepted, though structured abstracts will be preferred. If this trial is successful, JM^3 will eventually require structured abstracts in all its published papers.

To help explain what a structured abstract is and how to write one, the following information should be helpful.

1 What Is a Structured Abstract?

For the past 30 years, structured abstracts have become required in most medical journals,[1] though they are not very common in engineering and the physical sciences.[2] Simply put, the structured abstract forces the author to address the most important information that should be in every abstract by adding subheadings and subsections (the "structure") into the abstract. In engineering and physical sciences a five-structure format is the most appropriate: Background, Aim, Approach, Results, Conclusion. Each subsection should contain one to two sentences, answering the following questions:

> **Background:** What issues led to this work? What is the environment that makes this work interesting or important?
> **Aim:** What did you plan to achieve in this work? What gap is being filled?
> **Approach:** How did you set about achieving your aims (e.g., experimental method, simulation approach, theoretical approach, combinations of these, etc.)? What did you actually do?
> **Results:** What were the main results of the study (including numbers, if appropriate)?
> **Conclusions:** What were your main conclusions? Why are the results important? Where will they lead?

The benefit of the structured abstract is two-fold: it forces the author to include information from all five categories, and it makes these five sections easy to find and access. But while it is logical that structured abstracts will be better than unstructured abstracts, there is in fact proof that this is so. The preeminent researcher into the efficacy of structured abstracts, James Hartley, reviewed some 31 studies that had been performed by 2004 and found that these studies demonstrated the superiority of structured abstracts.[3] His review, as well as others,[4] showed that structured abstracts

- contain more information,
- are easier to read,
- are easier to search,
- facilitate peer review, and
- are preferred by readers and authors.

To illustrate, here is an abstract for a paper that I wrote:

> **Background:** Photoresist development rate can be defined microscopically (the development rate at a point) or macroscopically (the propagation rate of an average resist height). In the presence of stochastic noise, these two rates will be different.
> **Aim:** In order to properly calibrate lithography simulators, the difference between these two definitions of development rate should be quantified.
> **Approach:** Using theoretical derivations and a stochastic (Monte Carlo) resist simulator, the propagation rate of a resist surface is characterized in the presence of stochastic variation in the resist deprotection concentration and a nonlinear development rate response.
> **Results:** The resulting propagation rate can be more than an order of magnitude higher than for the case of no stochastic noise. Correlation in the development rate creates an effective surface inhibition over a depth into the resist of several correlation lengths.
> **Conclusions:** The differences between microscopic and macroscopic dissolution rate can have an important effect on how development rate models should be calibrated, depending on their use in continuum or stochastic lithography simulators.

Note that while structured abstracts are typically longer than traditional ones, the 166-word length here is right on target for JM^3 (we have a 200-word limit for abstracts).

2 Review Articles

Review articles may require different structured abstract headings. Generally, review articles follow one of these common themes:[5]

- A controversy: two or more camps with competing theories or explanations of a phenomenon, with evidence for each
- Progress towards the development of a major new tool, process, method, or theory
- Historical development leading to a major discovery or concept and its implications for today and the future
- Comparison of different approaches toward the measurement/design/fabrication/modeling of a specific thing of importance, and their advantages and disadvantages
- The use of a specific tool/process/method across disciplines or for different applications

- A novel insight gained from a wider view of recent progress on a topic, or the recognition of a critical new problem or issue previously unnoticed
- A call to action: why the community should devote considerable resources to a certain topic

Thus, the "Approach" of the structured abstract should describe the theme of the review article. Also, there generally are not new results in a review article, though occasionally the organization and synthesis of past work inherent to a review leads to the recognition of a new insight or a previously unnoticed issue that becomes a "result" of the review. Thus, here is a structured abstract for review articles:

> **Background:** What issues led to a need for this review? What is the environment that makes this review interesting or important?
> **Aim:** Why is this review needed? What organization and synthesis of past work is sought?
> **Review Approach:** What is the theme of this review (e.g., controversy, current progress, historical development, call to action, etc.)? What organizational principle was employed to carry out the review?
> **Results (optional):** What new insight was gained from the organization and synthesis presented in this review? What previously unnoticed new problem or issue has been recognized?
> **Conclusions:** What were your main conclusions? Why are the results important? Where will they lead?

Other types of articles (tutorials, outlooks, commentaries, perspectives, etc.) may or may not benefit from a structured abstract. Generally it can be left to the author to decide if an appropriate structure can be found and thus for these article types a structured abstract is optional.

3 Exceptions

The goal of structuring an abstract is to make it more informative and thus more useful to the reader. The vast majority of papers (including letters and review articles) would benefit from a structured abstract using the structure headings proposed above. It is possible, however, that some exceptional papers might require a different structure to meet this goal. Thus, if an author can justify a deviation from the standard abstract headings, the editor will consider allowing an exception. Note that the personal preference of the author is not an adequate justification for deviating from a structure that readers will come to expect and look for. Any justification for a deviation from the standard structure headings should be based on the benefits to the reader for such a deviation. A decision to allow a deviation from the standard structure rests solely with the editor.

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References

1. R. N. Kostoff and J. Hartley, "Open letter to technical journal editors regarding structured abstracts: this letter proposes that structured abstracts be required for all technical journal articles," *J. Inform. Sci.* **28**(3), 257–261 (2002).
2. Structured abstracts have been encouraged (but are voluntary) in *Phys. Rev. C* since 2011: https://journals.aps.org/prc/edannounce/PhysRevC.84.030001.
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4. C. Zhang and X. Liu, "Review of James Hartley's research on structured abstracts," *J. Inform. Sci.* **37**(6), 570–576 (2011).
5. C. A. Mack, "How to write a good scientific paper: review articles," *J. Micro/Nanolith. MEMS MOEMS* **15**(2), 020101 (2016).