Writing a Research Journal Article: A Brief Guide on How to Get Published

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Preamble

Communication is an integral part of the work performed by a scientist or researcher. A good article serves to gage the quality of the work and, at the same time, to provide a long-lasting body of knowledge from which other researchers and, ultimately, our society can benefit from. However, the task of writing a scientific paper can be a daunting job for graduate students and young researchers whose native language is not English.

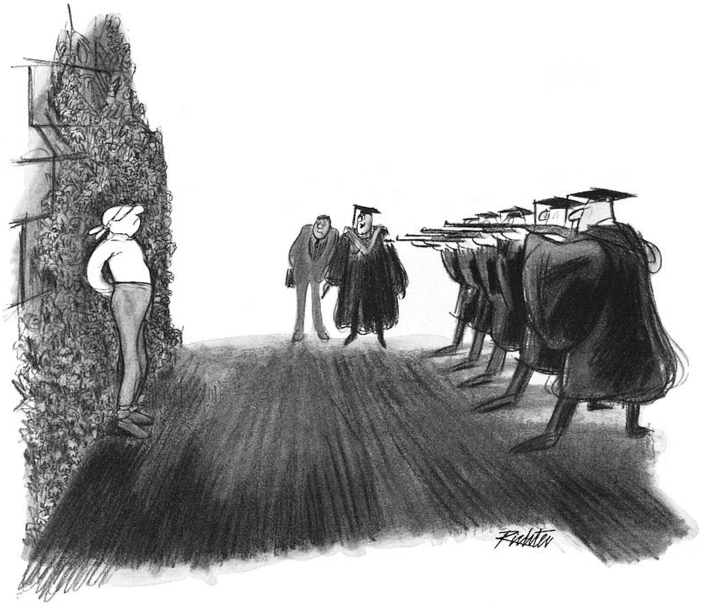
Building upon the author's own experience and his many years as a researcher and visiting scholar in a number of US and UK universities, this brief tutorial aims to help those graduate students and young researchers to write more effectively as a scientist and researcher, specifically in the English language, so that they can succeed in getting their research work published.

Outline

- The Basics: Why Write a Research Paper?
- A Few Things Before You Start
- The General Structure of a Good Research Paper
- The Writing Process: How to Write
- The Review Process
- Example Articles
- Closing
- Q&A

Why Publish a Research Paper ?

The Publish or Perish Dilemma



"It's publish or perish, and he hasn't published."

- *It should be the rule for serious researchers: if you don't publish you may not succeed in your academic career.*
- *Quantity does not matter. Focus on quality!*

Mischa Richter, New York Cartoons

Importance of Writing a Research Paper

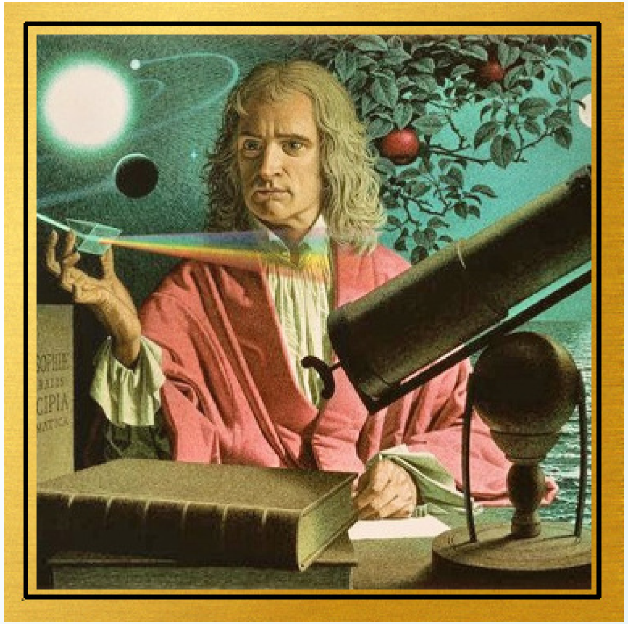
- Writing a research paper (and publishing it) is the primary channel for passing on knowledge to scientists and researchers working in the same or related fields.
- Research papers are a highly effective platform to disseminate and popularize the research work to a general or specific audience, thereby contributing to further developments and applications of the findings.
- Moreover, writing (and presenting/communicating) is an essential part of an academic career.

Writing in the Medieval Period

Monastery Scriptorium

Liturgical book, 1300–1310 Northern France

The Invention that Changed the World

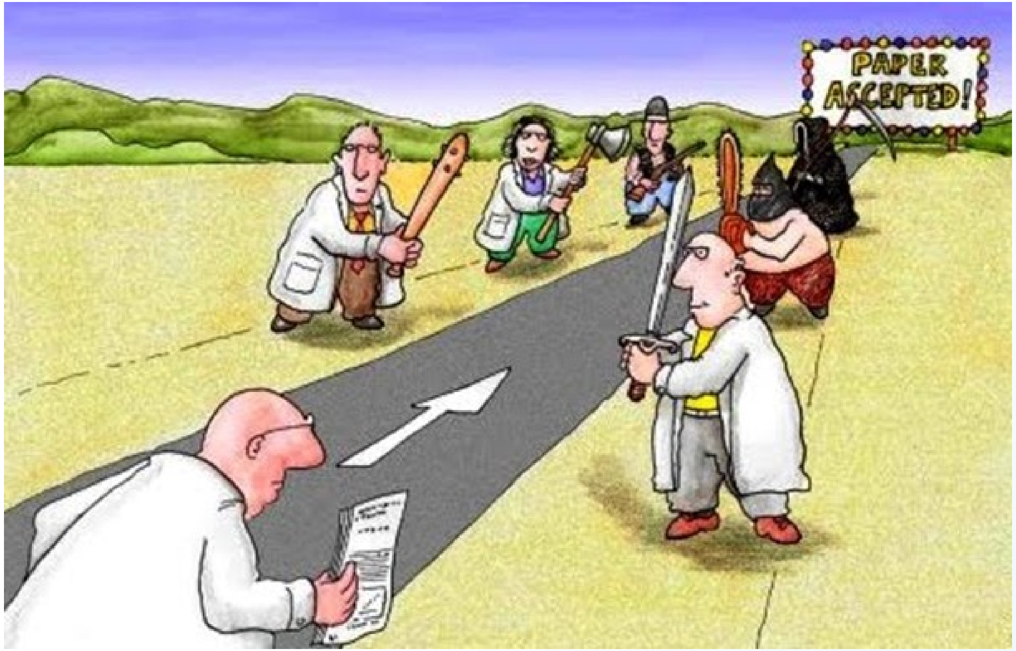


Johannes Gutenberg – circa 1440

The Pressure to Publish Academic Work

- **It doesn't matter whether or not you think it is fair (but who said that life is fair?): if you are an academic or young scientist/researcher, your publishing record will have a crucial impact on your career.**
- **Publishing good research papers can profoundly affect your prospects for climbing the academic ladder, opening the avenues for getting research grants and for gaining the respect of your peers.**
- **While the publication rate is not the only metric of an academic performance, the number of peer-reviewed articles and the number of citations are generally a good reflection of an academic reach.**

The Ruthless Darwinian Process of Publishing



The Conversation Newsletter, 2013. Cartoon by Nick Kim, Massey University, Wellington

Before You Start

Choose the Optimal Environment

The Article Content

- **Spend some time thinking about the article content and write down some ideas to create a general outline for the paper (using a top-down approach generally works well).**
- **Consider asking yourself a few key questions:**

  What is the message of the paper?

  Are there new results or contributions?

  Is the paper worth writing?

Know Your Audience

- Scientific and technical writing should focus on a specific audience and not be written as a general purpose document.
- Consequently, you should choose (and perhaps adapt) the style and level of writing, which may also include the structure of the paper, that is consistent and appropriate to your audience.
- Assess whether the topic of the paper is within the scope and format of the chosen journal and whether it would be consistent with the intended audience.

Decide Which Journal to Publish In

- **Make sure your work fits the aims and scopes of the journal.**
- **Moreover, several journals covering similar fields focus on different aspects of those fields. For example, one journal may focus primarily on theoretical aspects while others may favor experimental work and applications.**
- **Consider the journal's impact factor and whether the journal may perhaps be classified as a *predatory journal*, i.e., it accepts articles for publication (along with authors' fees) without any acceptable review process, thereby seriously compromising the article quality.**

Use of Word Processing Software

- **While MS Word has been around for years, consider using a more advanced, scientific-oriented word processing software, such as *LaTeX* (or, similarly, Lyx/MikTex in conjunction with JabRef and TeXstudio).**
- **Currently, most of the world's publishers, including Elsevier and Springer, not only already adopt *LaTeX* as their primary file format, but they use it in the final production of the article.**
- **Thus, using *LaTeX* not only significantly improve the quality of your draft article (i.e., the manuscript which is submitted for review), but also significantly expedite the production of the accepted article.**

The Structure of a Research Paper

Basic Structure

- Abstract
- Introduction
- Methods / Background
- Results
- Discussion
- Summary and Conclusions
- Acknowledgements
- References

Another Basic Structure

- Abstract
- Introduction
- Methods / Background
- Results and Discussion
- Summary and Conclusions
- Acknowledgements
- References
- Appendix

The Abstract

- **A single paragraph preceding the main body of the article that summarizes the content and may serve as its index, thereby helping in the library database search.**
- **The abstract should inform the reader in a concise manner about the focus (i.e., what the article is about) and the major contributions under discussion.**

The Introduction

- **It is perhaps the most important section in the article as it will provide the motivation and relevance of the work, bring attention to the reader and pave the way for the developments and contributions that follow in the article.**
- **The introduction should also be broken down into smaller sub-sections (each one usually associated with one or two paragraphs) following a logical presentation, as briefly illustrated next.**

Subdividing the Introduction

- **The first paragraph should clearly bring attention to the reader by starting with a general topic and then narrowing down the problem.**
- **After introducing the problem, the middle paragraphs serve to describe more specifically, if needed, the problem addressed in the article and, at the same time, provide a literature review.**
- **The introduction ends with a *road-map* description than can either give a general outline of the contribution or a specific, section-by-section breakdown of the remaining article.**

Methods and/or Theoretical Background

- **One or more sections detail the methods and/or theoretical background used in an objective and sound manner.**
- **They should be specific and provide the necessary background to support the results and conclusions.**
- **Moreover, the reader should be able to interpret and assess the quality of the results presented in the article.**
- **Depending on the intended scope, the description of methods or theoretical background can be presented in subsections covering more specific topics.**

Results and Discussion

- **Presentation of results in a separate section allows for more flexibility in terms of organization and content as they are simply results – therefore, this is not the place for drawing conclusions.**
- **However, the results are often combined with the discussion in the same section, which enables interpretations and potential implications in the same section.**
- **While several journals require the results and discussion to be in separate sections, putting them together avoids repetition and facilitates interpretations in parallel with the results.**

Summary and Conclusions

- The summary and conclusions should be short and as specific as possible to highlight important outcomes regarding elements that were previously presented and discussed.
- As a rule of thumb, this section should contain two or three paragraphs. The first paragraph provides an overview of the various sections discussed in the article, whereas the second paragraph (and possibly the third paragraph) draws the important conclusions.
- It may be a good idea to conclude the section by including future research directions that follow naturally from the article.

Acknowledgements

- **The acknowledgments are given at the end of the article to formally recognize institutions, funding agencies and individuals that contributed to the work.**
- **Always acknowledge financial support of the research by, for example, giving the name of the funding agency and grant or contract number.**
- **Acknowledge research contributions by people other than the authors, including those who gave scientific guidance and further insights or shared unpublished results and thoughts.**

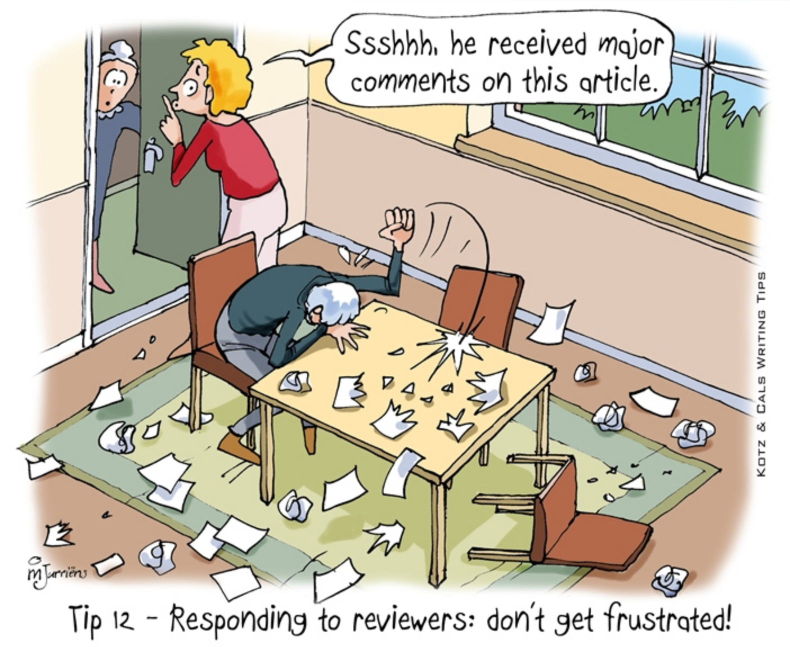
References

- The references in your work also demonstrate your knowledge in the field which the article relates to.
- All the cited reference works must appear as a list that should follow the formatting requirements of the journal in which the article was submitted to.
- Refereed journal articles, books, refereed conference proceedings and research monographs and reports are preferred.
- If possible, avoid including references written in a language other than English.

How to Write

First Things First

- **Bear in mind that mastering the English language, albeit very important, does not necessarily guarantee the success of a journal article since writing a good scientific paper is almost an art. It takes a lot of persistence and a lot of time to prepare a single paper for publication.**
- **Thus, you need to have a writing strategy and develop your research paper in a structured and organized way.**



scientificwritingtips.wordpress.com

Before Starting Writing

- Do not just describe your work. Plan what you are going to write.
- Even well-written manuscripts are rejected due to lack of novelty. Ask yourself what is new and relevant in your work. Emphasize the contribution of the work.
- Outline the article by structuring and organizing the contents into smaller blocks of related topics
- Focus on high quality data not quantity or volume of data. Including irrelevant data does not add to the quality of the manuscript and deviates the reader's attention. Moreover, focus on the effectiveness of the communication.

Focus on the Reader

- The primary purpose of a technical writing is to disseminate ideas and research results. Thus, write it clearly and concisely.
- Provide clear and accurate explanation, particularly in the case of key topics of the article, without ambiguities. Never let the reader guess what is under discussion or being presented.
- Put yourself in the reader's place and ask yourself whether you would interpret what is written correctly.
- Use plain and simple English with good writing flow.

Make Your Work Interesting to the Reader

www.nature.com

- *Many scientific papers fail to usefully communicate research work to their audience. They focus on the authors instead of on the readers by failing to clarify the motivation for the work or by including unnecessary details.*
- *Effective scientific papers, in contrast, are interesting and useful to many readers, including newcomers to the field.*

How to Make Your Writing Flow

- **Good writing flow is essential to the quality of your article by ensuring solid coherence of the key points and proper word choice.**
- **Ensure that paragraphs have a clear organizational and solid structure.**
- **Use transition words, such as “thus” or “however”, to signal the reader that the next sentence has some relation to the previous one.**
- **Although very long sentences are not recommended, it is also a good idea to use varied sentence lengths and structures to break up the monotony of the text.**

Illustrations and Figures

- Illustrations represent a key ingredient to your article because figures and tables are the most efficient way to present results.
- Moreover, good results are THE driving force of your article. Consequently, even if what you wrote in the article is sound and well developed, the review of the article may be severely penalized by poor illustrations, including graphs and plots.
- Captions and legends must be detailed enough to make figures and tables essentially self explanatory.

General English Writing Tips I

- **Poor English makes it difficult for the editors and, particularly, reviewers to understand your work and ultimately your article. This might lead to rejection of your paper.**
- **Common English mistakes include (but not limited to):**

  Poor sentence construction

  Incorrect tenses and too much passive voice

  Inaccurate grammar

  Use of words with different meanings. Here, use a good dictionary such as, for example, the Merriam Webster.

A Simple Example

- **Portuguese: “*O projeto de estruturas <u>navais</u> requer conhecimento*”.**

naval

adjective

na·val ˈnā-vəl

Synonyms of *naval*

1

obsolete : of or relating to ships or shipping

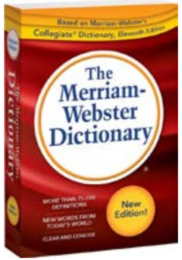
2

a

: of or relating to a navy

b

: consisting of or involving warships



- *The design of ship structures requires knowledge.*
- *The design of marine structures requires knowledge.*
- *The design of ocean structures requires knowledge.*

General English Writing Tips II

- **Avoid using long structures when they can be replaced by short ones.**

  For example, instead of writing "In order to generate the numerical solutions for …", simply use "To generate the numerical solutions for …"

- **Avoid writing in passive voice.**

  For example, instead of writing "It can be seen in the plots …" or, even worse, "It has been shown in the plots …", simply use "The results displayed in the plots show …"

General English Writing Tips III

- In a scientific paper, a general rule is to use verb tenses (past, present, and future) exactly as you would in ordinary writing.
- Use the past tense to report what happened in the past: what you did, what someone reported, what happened in an experiment.
- Use the present tense to express general truths, such as conclusions (drawn by you or by others) and atemporal facts (including information about what the paper does or covers).
- Reserve the future tense for perspectives: what you will do in the coming months or years.

General English Writing Tips IV

- **Alternatively, when referring to previously published work, it is fine to refer to it in present tense:**

  Johnson and Lambert provide a numerical method to solve the nonlinear system of partial differential equations.

- **Moreover, when describing your own work or study, refer to it in past tense:**

  In previous work, we developed an improved numerical method to solve the nonlinear system of partial differential equations.

General English Writing Tips V

- **To WRITE in English, it is best to THINK in English and not in your foreign language.**
- **That is because a foreign language most likely uses concepts not present in the English language or that are present in the English language in a different way or to a different extent.**
- **Several examples include the correct use of prepositions, verbal tenses and words that have similar forms but different meanings.**
- **Always double check whether the sentence construction, the verbal tense or the use of a preposition are correct.**

The Review Process

What to Expect

- Before sending your article out to a journal, revise and edit it thoroughly even if it appears time consuming.
- Most journals will require that your article be reviewed by 2 to 4 reviewers, who will primarily focus on the scientific merit, novelty and contribution. However, while they will likely not correct English grammar or poor sentence construction, these will negatively influence their judgment on the scientific merits and contribution of your work.
- By writing your article with good literary English and good writing flow, you will increase the chances of a favorable review, since the reviewers will focus on what really matters, which is the article's scientific merit.

Reaching the Reviewer

- Do not underestimate the review process since most reviewers will really go through your paper in detail only if they can form a good opinion about the work. The rejection rate in many typical engineering journal is $\pm$ 30%.
- Firstly, they read the abstract to see if the paper is interesting. Then, they skim through the Introduction to form a first opinion about the paper.
- Next, they read the rest of the paper searching for evidences that support the quality of the work and the results.
- Depending on the structure, organization, writing and results, by the time they get to Section 2 or Section 3, they may have already formed their opinion whether to accept or reject the paper.

Your Paper is Accepted: What Now?

- Once the article is accepted and the final version is published, it will hopefully achieve one of its primary objectives, which is to present your research and associated results to a broader audience.
- Bear in mind, however, that once your paper is published, there is no going back! What was published stays there for the whole world to read it.
- Consequently, carefully review all equations, tables, figures and data that were provided in the article. In general, the reviewers will not check the correctness of every equation and, certainly, will not check the consistency of all data provided in the tables and figures of your article.

Example Articles

The Abstract

Contents lists available at ScienceDirect

Journal of the Mechanics and Physics of Solids

journal homepage: www.elsevier.com/locate/jmps

A mechanical model for reinforced, expanding spirally-wound layered materials

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A R T I C L E I N F O

MSC:
35B27
74B05

PsycINFO Classification:
Composite materials

Keywords:
Asymptotic analysis
Homogenisation
Linear elasticity

A B S T R A C T

Mechanical deformations induced by expansion within an elastic material which is spirally-wound in layers with a thin inextensible reinforcing material are considered. The motivation is to understand behaviour of spirally-wound batteries where both the active material and the metal current collectors expand due to changes in lithiation and/or temperature. This paper considers a spiral made from a single reinforcing layer with a matrix layer of linear elastic material, whose properties may vary through the layer. The layers undergo prescribed isotropic expansion, where the matrix expansion may depend on the macroscopic radial coordinate. Asymptotic homogenisation, exploiting the small scale of the layer thickness relative to the large scale of the overall spiral structure, reveals the bulk of the spiral has an unexpected simple behaviour while there are boundary layers in a surface region near the inner and outer windings. There are further finer-structure boundary layers at the very beginning and very end of the spiral. In all these regions analytical solutions are found providing simple expressions for the deformations and in particular the tension in the inextensible layer. Comparisons are shown between these expressions and detailed finite-element solutions of the problem. These reduced-order models provide a simple way of accounting for stresses induced by expansion of the spiral structure.

Introduction Section

PERGAMON

Engineering Fracture Mechanics 63 (1999) 347–374

Engineering Fracture Mechanics

www.elsevier.com/locate/engfracmech

Three-dimensional modeling of ductile crack growth in thin sheet metals: computational aspects and validation

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Subdividing the Introduction

- **The first paragraph should clearly bring attention to the reader by starting with a general topic and then narrowing down the problem.**
- **After introducing the problem, the middle paragraphs serve to describe more specifically, if needed, the problem addressed in the article and, at the same time, provide a literature review.**
- **The introduction ends with a *road-map* description than can either give a general outline of the contribution or a specific, section-by-section breakdown of the remaining article.**

First Paragraph

1. Introduction

The accurate prediction of ductile crack growth in thin aluminum components plays a key role in the structural analysis of aging aircraft [1,2]. The outer shells of aircraft structures make extensive use of thin aluminum components that have a thickness of a few millimeters and in-plane dimensions of several meters. During service, pressurization cycles subject the aircraft to repetitive loading, creating through-thickness fatigue cracks in components, for example at rivet holes and lap joints. These components may undergo significant ductile tearing and crack coalescence prior to component failure. The specification of appropriate inspection intervals and critical flaw sizes requires computational tools which can effectively predict the growth of these cracks. Models of crack growth for use in engineering analysis should employ a criterion with a clear, simple calibration procedure, and which provide analyses that are reasonably invariant to such factors as sheet thickness, crack and loading geometry, absolute specimen size, buckling behavior, and the influence of multiple cracks.

Second Paragraph

Methodologies to model ductile crack growth in a finite element setting have evolved primarily along two lines of development: approaches based on damage mechanics that use accumulated damage along the crack front as a growth criterion, and approaches that control crack extension via a macroscopic measure of deformation. Current research in the first category often uses the Gurson–Tvergaard (GT) constitutive model [3–5] to characterize the void nucleation, growth, and coalescence process driving crack growth. Various researchers [6,7] have shown that such approaches are highly effective in producing geometry- and loading-independent predictions of crack growth in 2D and 3D for typically thick sections of ductile steels. However, the GT constitutive model relies upon high levels of stress triaxiality to drive the damage process. Thin aluminum components cannot develop sufficient through-thickness stress to provide high stress triaxiality at the crack tip; the void growth and coalescence process more typically occurs along bands of large plastic strain. Therefore, GT-based approaches appear less applicable for thin specimens. Modeling approaches based on macroscopic levels of deformation, such as the Crack Tip Opening Angle (CTOA), appear to provide a viable growth criterion for thin materials [8–10].

Last Paragraph

This study explores further extensions of the CTOA criterion to 3D models for ductile crack growth in thin aluminum sheets that experience out-of-plane bending, initial blunting at the crack tip and tunneling of the extending crack front. Section 2 outlines the CTOA modeling strategy in a 2D framework, then discusses two extensions of the CTOA approach for 3D analyses of planar (Mode I) growth and as an approximation for slant fracture. The general 3D extension enables crack tunneling by defining the crack growth criterion based upon the local CTOA at each crack front node. Alternatively, an extension that enforces a constant front (uniform growth along the crack front) grows the crack in a self-similar manner. To provide crack growth analyses independent of mesh resolution, the constant front approach evaluates the CTOA at a specified distance behind the crack tip. Both the general 3D and constant front extensions of the CTOA

Last Paragraph (cont.)

converges to a unique result with increased mesh resolution. A validation study described in Sections 3 and 4 demonstrates application of the constant front approach for prediction of crack growth in thin aluminum panels tested by Dawicke and Newman [9,10] at NASA-Langley. These tests on thin Al 2024-T3 panels encompass a range of absolute sizes, specimen types, crack length to width (a/W) ratios, and levels of out-of-plane bending suppression. The validation procedure calibrates the critical CTOA value using a 150 mm C(T) specimen, then uses the calibrated value to predict growth response in the other specimen configurations. In all cases, the predictions of load-crack growth response are in good agreement with experimentally measured responses. The comparisons show a possible weak dependence of the critical CTOA value on specimen size, which is also suggested by theoretical arguments. Nevertheless, the results suggest that use of a single, critical CTOA value is valid for engineering analyses for a wide range of specimen sizes and types.

Closing Section

5. Summary and conclusions

This study describes two extensions of the CTOA approach for 3D finite element modeling of stable crack growth in thin aluminum panels. The general 3D extension evaluates the CTOA locally at each crack front node which permits crack growth in any direction on the crack plane. To avoid the prediction of unrealistic crack front profiles, meshes must have elements with 1:1 aspect ratios along the crack plane. This severely restricts the types of problems that are computationally feasible using the general 3D method. The alternative, constant front extension method enforces uniform growth (usually straight) along the crack front. The CTOA is defined at an analyst-specified distance (L_c) behind each crack front which eliminates restrictions on mesh refinement along the crack plane and enables convergence studies to insure crack growth predictions remain independent of the mesh resolution. The constant front approach thus provides significant advantages over the general 3D method. Adaptive load control strategies eliminate errors that otherwise arise with larger load steps and generally decreasing fracture resistance at large crack extensions.

Closing Section (cont.)

Verification studies of the constant front approach use measured load-crack extension responses generated from tests of Al 2024-T3. The experimental program tested 2.3 mm thick C(T) and M(T) specimens with a range of absolute sizes and a/W ratios. The program includes a full set of tests with guide plates to constrain out-of-plane bending, and additional tests on large M(T) specimens with extensive out-of-plane bending. Calibration of the constant front model using a 150 mm constrained C(T) specimen yields a critical CTOA value of 5.1°. This CTOA value enables predictions of the failure (maximum) loads for the constrained C(T) and M(T) specimens within 9% of the experimental values with an average error of about 4%. The analyses increasingly over-predict the failure load as specimen size increases. This suggests a weak dependence of the critical CTOA on specimen size, which can also be argued from theoretical considerations. The over-prediction may also be caused in part by failure of the buckling guides to prevent fully out-of-plane displacements. Analyses for the M(T) specimens with extensive out-of-plane bending provide predictions that agree well with experiments for both the out-of-plane displacements and the load-crack extension response. Overall, the constant front 3D CTOA mechanism as described in this paper holds significant promise for engineering estimation of crack growth in thin aluminum components.

Other Sections I

Hydrogen embrittlement of ferritic steels: Observations on deformation microstructure, nanoscale dimples and failure by nanovoiding

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Other Sections II

Elastic-Plastic Analysis of Cracks on Bimaterial Interfaces: Part III—Large-Scale Yielding

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In Parts I and II, the structure of small-scale yielding fields of interface cracks were described in the context of small strain plasticity and J_2 deformation theory. These fields are members of a family parameterized by the plastic phase angle ξ which also determines the shape or phase of the plastic zone. Through full-field analysis, we showed the resemblance between the plane-strain interface crack-tip fields and mixed-mode HRR fields in homogeneous material. This connection was exploited, to the extent possible, inasmuch as the interface fields do not appear to have a separable form. The present investigation is focused on "opening" dominated load states ($|\xi| \leq \pi/6$) and the scope is broadened to include finite ligament plasticity and finite deformation effects on near-tip fields. We adopt a geometrically rigorous formulation of J_2 flow theory taking full account of crack-tip blunting. Our results reveal several surprising effects, that have important implications for fracture, associated with finite ligament plasticity and finite strains. For one thing the fields that develop near bimaterial interfaces are more intense than those in homogeneous material when compared at the same value of J or remote load. For example, the plastic zones, plastic strains, and the crack-tip openings, δ_t, that evolve near bimaterial interfaces are considerably larger than those that develop in homogeneous materials. The stresses within the finite strain zone are also higher. In addition, a localized zone of high hydrostatic stresses develops near the crack tip but then expands rapidly within the weaker material as the plasticity spreads across the ligament. These stresses can be as much as 30 percent higher than those in homogeneous materials. Thus, the weaker material is subjected to large stresses as well as strains—states which promote ductile fracture processes. At the same time, the accompanying high interfacial stresses can promote interfacial fracture.

Closing

A Final Word

Despite the daunting task of writing a scientific article about your research work, it is an undeniable great achievement not only to see your words in print, but, perhaps more importantly, to receive the recognition of your work by your peers.

Thus, the need to publish should not lead to despair, but, on the contrary, it should be a pleasure, not a pressure. It should be a focal point in which good ideas and solid research work converge to produce scientific and technological knowledge which the entire society can benefit from.

Thanks!

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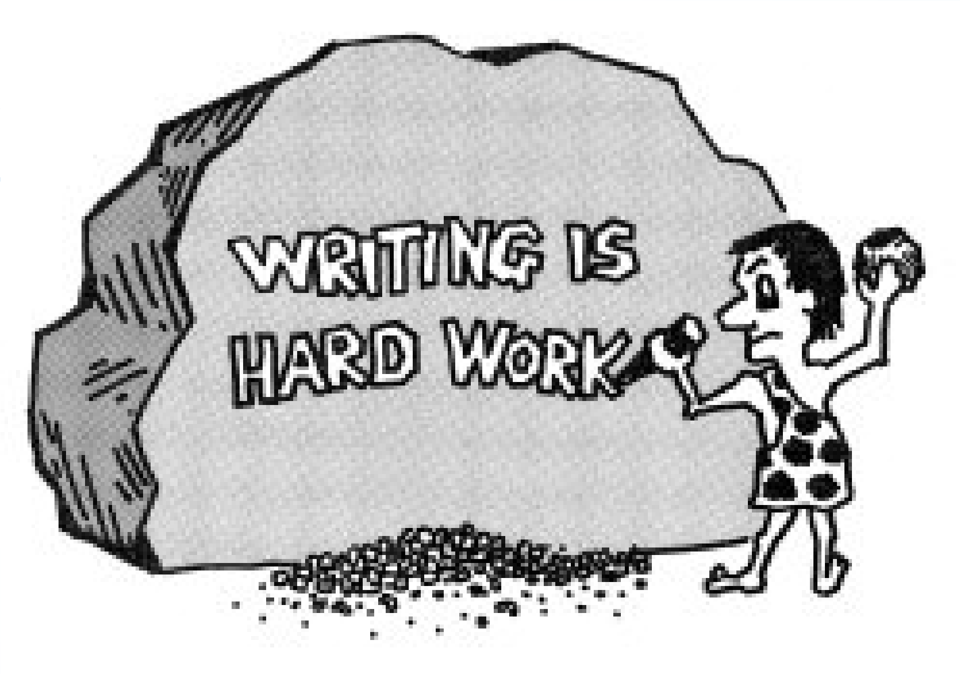

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