如何撰写高质量的科技论文

阮新波

南京航空航天大学

航空电源航空科技重点实验室

APSC
Aero-Power Sci-tech Center

报告内容

- 写科技论文的意义
- 科技论文的基本结构
- 国际期刊评审论文的标准
- 提高论文质量的方法
- 结语

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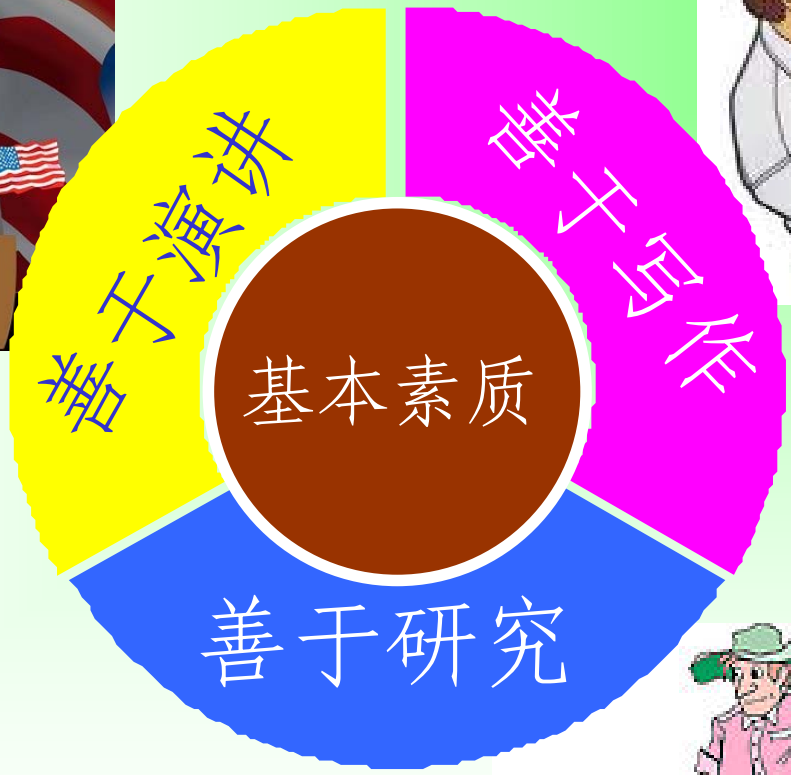
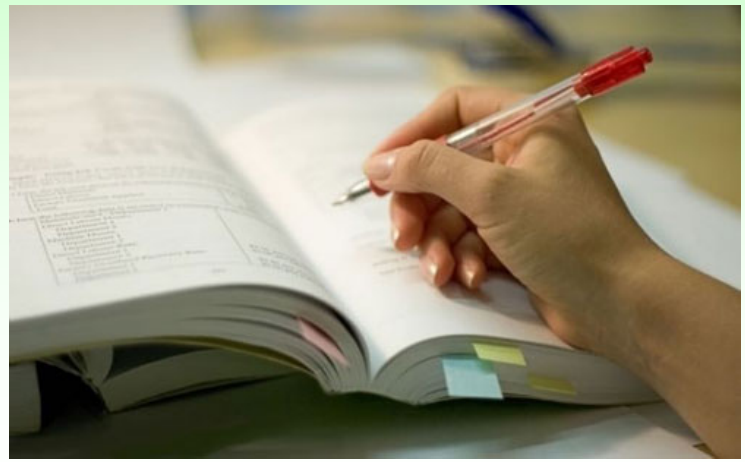
优秀学生应具备的基本素质



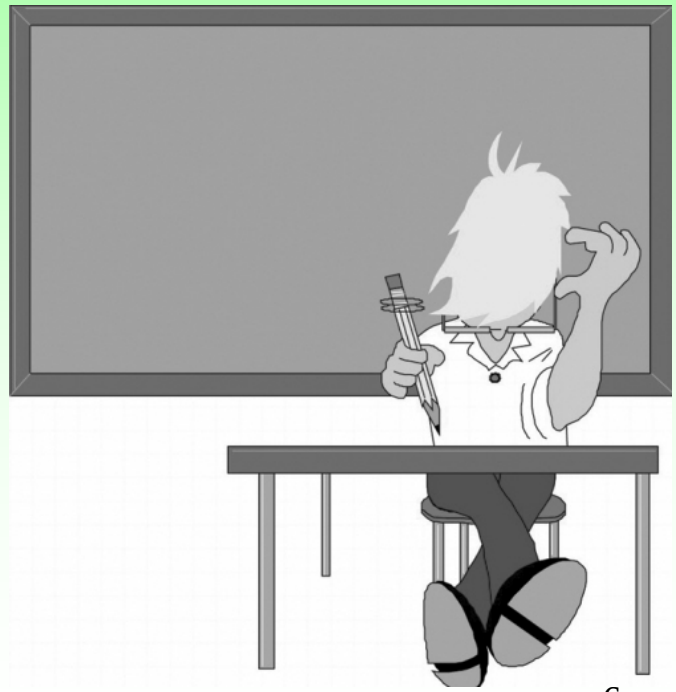
写论文对研究领域的贡献

- 科技论文是对科学研究中提出的**新思想、新方法、新概念**等的**总结和阐述**。
- 发表论文是为了与同行**分享**所取得的**科研成果**，是对本领域的贡献。
- 发表论文是**获得同行认可、建立学术地位**的一种途径。
- 是**职称晋升、学生毕业**的一个重要指标。



写论文对自己的帮助

- 撰写科技论文是对研究工作的**整理、再认识**，可以提高自己的总结能力；
- 有利于弄清某些在研究中似是而非、没有完全明白的问题，是研究过程的**重要组成部分**；
- 撰写论文的过程中，甚至可以**产生新的灵感**。
- 有利于形成**良好的思维方式**。



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论文题目(Paper Title)

作者(Authors)

- 摘要(Abstract)
- 关键词(Index Terms)
- 正文(Main Body)
- 结论(Conclusion)
- 致谢(Acknowledgment)
- 参考文献(References)
- 作者简介(Biography of Authors)

论文题目

论文题目要充分、合适、具体地反映论文的主要内容、主要贡献，切忌太长、太大、太空，慎用“新颖的”等词汇，最好不用缩写。

☺

- Means of Eliminating Electrolytic Capacitor in AC/DC Power Supplies for LED Lightings
- Variable-Duty-Cycle Control to Achieve High Input Power Factor for DCM Boost PFC Converter

☹

- 直流变换器的研究
- 一种新颖的感应电机控制方法
- An DEM for Buck-Boost Converter
  (*DEM: Dual Edge Modulation*)

论文署名

- 只有对本文**作出贡献**的作者才能署名；
- 署名顺序**按贡献大小排列**，第一作者应为本文的主要贡献者；
- 本研究工作的经费资助者如果对本文没有贡献，**不可以**作为合作作者署名。但须在致谢中表达谢意。

论文摘要

- 摘要主要说明本文的**主题、提出的方法和得出的结论**。
- 摘要自身应成为一个**有价值的文献**，特别要包括本文的**关键词**，让读者在阅读本文前就大致知道本文的主要内容和贡献，而且容易被搜索引擎搜索到。
- 摘要中**不能**包括公式、参考文献。
- 摘要一般不超过**200个单词**。

论文摘要

This paper proposes two methods of reducing the storage capacitance in the ac/dc power supplies for light emitting diode (LED) lighting. In doing so, film capacitors can be adopted instead of electrolytic capacitors to achieve a long power supplies' lifetime. The voltage ripple of the storage capacitor is intentionally increased to reduce the storage capacitance. The method of determining the storage capacitance for ensuring that the boost power factor correction converter operates normally in the whole input voltage range is also discussed. For the purpose of further reducing the storage capacitance, a method of injecting the third harmonic current into the input current flow is proposed. While ensuring that the input power factor is always higher than 0.9 to comply with regulation standards such as ENERGY STAR, the storage capacitance can be reduced to 65.6% of that with an input power factor of 1. A 60-W experimental prototype is built to verify the proposed methods.

关键词

- 关键词必须表明本文的相关领域、主题。
- 关键词一般为专业词汇和通用的词汇，以便于搜索引擎搜索到。
- 关键词一般为**3~5个**。

Harmonic current injection, Light-Emitted Diode (LED), power factor correction (PFC), power supply, voltage ripple.

引言

- 明确本文的研究对象及其研究意义(重要性、应用前景)。
- 对相关研究工作进行恰当评述(国内外现状)，并指出存在的问题和不足。
- 本文的主要贡献(针对什么问题提出什么方法，结果如何)。
- 简要说明本文的架构。

- 引言是论文最难写的部分。
- 需要有较大的阅读量，尤其是阅读相关领域重要期刊和会议论文。

引言

The rapid development of LED over the last few years has opened up new opportunities in the general illumination market, thanks to its distinct advantages such as high efficacy, long lifetime, environmental friendliness, and small size over incandescent and fluorescent lamps [1]–[4]. The power supply for LED lighting is an ac/dc converter, which converts a regular ac voltage to a low dc voltage for an LED driver. The input power factor is an important requirement of the ac/dc converter. It needs to be higher than 0.9 for most commercial luminaries [5]. Thus, the ac/dc converter must typically have the function of power factor correction (PFC). In a PFC converter, the input current is forced to be in phase with the input voltage, leading to a pulsating input power, while the output power is constant. To achieve this, a large electrolytic capacitance is required for balancing the instantaneous power difference. Due to the high capacity required for capacitance, an electrolytic capacitor is often used as the storage capacitor. However, it is well known that because of its liquid electrolyte, the lifetime of an electrolytic capacitor is quite limited with only several thousand hours under rated operating conditions. Even with a conservative design, the theoretical lifetime of electrolytic capacitors is about 3 000 h (at a high operating LED's temperature) [6]. This is much shorter than the potential lifetime of LEDs (50 000 h). Thus, the electrolytic capacitor is an obstacle to the overall long-term reliability of the LED and its power supply.

LED的优点

LED电源需要
功率因数校正(PFC)功能

PFC变换器需要很大的储能电容

储能电容寿命较短，
与LED的长寿命不相匹配

引言

A review of literature shows that a variety of LED power supplies and driver solutions, which can accurately control the current of the LED while achieving a near-unity input power factor, have been proposed [7]–[10]. However, an electrolytic capacitor is required in these applications.

PFC变换器的研究综述，
指出这些方案都不能减小储能电容

PFC converters can be classified into two-stage and single-stage. Two-stage PFC converters consist of a PFC stage and a dc/dc stage. They have been widely applied in adaptors for laptops and silver box [11]–[14]. Single-stage PFC converters integrate the PFC stage and the dc/dc stage, leading to simple topology and low cost. They are suitable for low-power applications [15]–[18]. Unfortunately, no effective method has been proposed to significantly reduce the storage capacitance in a PFC converter such that a long lifetime of a converter can be achieved.

正文主体部分

- 阐述所提出方法
- 相关理论分析
- 仿真和实验验证

II. Increase of the Voltage Ripple to Reduce the Storage Capacitor

A. Relationship Between Voltage Ripple and Storage Capacitance of a Two-Stage PFC Converter

B. Maximum, Minimum, and Average Values of the Storage Capacitor's Voltage

C. Design Example

III. Injection of Harmonic Current to Reduce the Storage Capacitor

A. Relationship Between Storage Capacitance and Input Power Factor

B. Relationship Between Third Harmonic Injection and Storage Capacitance

C. Control Method of Third Harmonic Injection

IV. Experimental Verification

结论

- 对本文工作进行小结，简要概括本文所提出的新方法、新理论和新技术，说明它们的优点。
- 可分1, 2, …, n点，也可分几段。
- 不要含有参考文献，公式和图表。
- 部分内容可与摘要重复。

结论

This paper proposes two methods that can be used to significantly reduce the storage capacitance, so that film capacitors, instead of electrolytic capacitors, can be adopted to achieve a long lifetime of the PFC converter. In a two-stage PFC converter, a storage capacitor is used to balance the pulsating input power and the dc constant output power. To significantly reduce the storage capacitor, the voltage ripple of the storage capacitor can be intentionally increased. However, a very large voltage ripple can result in the unstable operation of the boost PFC converter and a very high voltage stress on the power switches. This paper gives the derivation of the relationship between the voltage ripple and the value of the storage capacitor, and proposes a guideline for the selection of a suitable value for the storage capacitor. Moreover, a method of injecting the third harmonic current into the input current flow is proposed to reduce the pulsation of the input power. This can further reduce the storage capacitance. While keeping the input power factor at 0.9 to comply with the requirement of ENERGY STAR, the storage capacitor can be reduced to 65.6% of that with an input power factor of 1. A 60-W prototype was built and tested. Experimental results validated the feasibility of the proposed methods.

致谢

- 本文工作的资助方。
- 参与讨论并提供有价值建议的人员。
- 提供功率器件及相关设备的公司和人员。
- 帮助样机制作的技术人员。
- 相关测试人员。
- ……

ACKNOWLEDGMENT

- The authors would like to thank **the National Natural Science Foundation of China (NSFC)** for the financial support under the award 50837003.
- The authors would like to thank **S. Y. Lam** for able assistance in developing the experimental prototypes.
- The authors would like to acknowledge **the contribution of Golden Regent Electronics Industrial Limited** for making the high-voltage transformer.
- The authors would like to thank **Dr. S.-C. Tan** from Hong Kong Polytechnical University, Kowloon, Hong Kong, for the revision of this paper.

参考文献

Style for conference publications: Authors (first initials followed by last name), title of paper, in title of conference, date of conference, and page numbers (inclusive).

[1] A. B. Researcher and I. N. Elper, "Loss-based analysis of switching converters under closed-loop controls," in *Proc. IEEE Applied Power Electronics Conf.,* 2010, pp. 3917-3926.

Style for periodical journal publications: Authors (first initials followed by last name), title of paper, title of periodical, volume, page numbers (inclusive), month and year.

[2] C. D. Aodiet, R. G. Gue, and P. R. Phakter, "The Ran-Duga method for ac-ac converter operation," *IEEE Trans. Power Electronics,* vol. 37, pp. 7721-7727, October 2014.

Style for books: Authors (first initials followed by last name), book title. Publisher location: publisher name, year, chapter or page numbers.

[3] B. B. Eriffel, *The Design of Microwatt Power Devices.* London: Energy Unit Publishers, 2012, Chap. 72.

作者简介

Xinbo Ruan (M'97–SM'02) was born in Hubei Province, China, in 1970. He received the B.S. and Ph.D. degrees in electrical engineering from the Nanjing University of Aeronautics and Astronautics (NUAA), Nanjing, China, in 1991 and 1996, respectively.

In 1996, he joined the Faculty of Electrical Engineering Teaching and Research Division, NUAA, where he became a Professor in 2000 with the College of Automation Engineering and has been engaged in teaching and research in the field of power electronics. From August to October 2007, he was a Research Fellow in the Department of Electronics and Information Engineering, Hong Kong Polytechnic University, Hunghom, Hong Kong. Since March 2008, he has been with the College of Electrical and Electronic Engineering, Huazhong University of Science and Technology, Wuhan, China. He has authored or coauthored more than 100 technical papers in international conferences and also published three books. His current research interests include soft-switching dc/dc converters, soft-switching inverters, power factor correction, modeling of the converters, power electronics system integration, and renewable energy generation system.

Dr. Ruan was the recipient of Delta Scholar by the Delta Environment and Education Fund in 2003, and was awarded the Special-Appointed Professor of the Chang Jiang Scholars Program, by the Ministry of Education, China, in 2007. He is also the Guest Professor of Beijing Jiaotong University, China, and Hefei University of Technology, China. Since 2005, he has been the Vice President of China Power Supply Society, and since 2008, he has been the member of the Technical Committee on Renewable Energy Systems within the IEEE Industrial Electronics Society. He is a Senior Member of the IEEE Power Electronics Society and the IEEE Industrial Electronics Society.

姓名，出生地点、日期，学历

工作经历

发表论文和获得专利

研究兴趣或方向

获得荣誉

学术兼职

学会会员

- 写科技论文的意义
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IEEE Transactions on Power Electronics的评阅表

Basic Qualification Questions

- What is the **new contribution** of this paper? (Based on your assessment rather than on author statements.)

- Does the contribution have **good archival value**, or is it only an **incremental addition to existing knowledge**?

IEEE Transactions on Power Electronics的评阅表

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Paper Grading

Original, elegant	5, …, 0	Restatement of existing knowledge
Valuable for practicing engineers	5, …, 0	Impractical or excessively commercial
Technically and mathematically accurate	5, …, 0	Unsound; contains significant errors
Well supported with analysis/experiments	5, …, 0	Unproven, unsupported
Rich in engineering judgement and insight	5, …, 0	Uninformed, amateurish
Clear, concise, effective presentation	5, …, 0	Obscure, disorganized, verbose
Interesting to readers, stimulates new ideas	5, …, 0	Uninteresting; topic is nearly cliche
Effective illustrations and tables	5, …, 0	Poor figures or figures without discussion
Correct English usage	5, …, 0	Weak grammar; difficult to follow
Useful references to past work	5, …, 0	No context is provided beyond the authors' work

IEEE Transactions on Power Electronics的评阅表

Aero-Power Sci-tech Center

Recommendation

☐	**Accept without change** - The paper can be published in its present form.
☐	**Accept with suggested change** - The paper can be published in its current form but could be made stronger by incorporating changes suggested by the reviewers.
☐	**Accept with mandatory changes** - The paper cannot be published in its current form but can be provisionally accepted if the authors incorporate mandatory changes suggested by the reviewers. It is the opinion of the reviewers that the changes are relatively minor and can be incorporated in ten weeks or less.
☐	**Do not accept** - The paper cannot be accepted in its current form. The reviewers should indicate why the paper cannot be accepted and suggest the paper could be accepted after a major revision.

○	**Accept**
○	**Minor Revision**
○	**Major Revision**
○	**Reject & Resubmit**
○	**Reject**

IEEE Transactions on Power Electronics的评阅表

Comments

- Confidential comments to the Editor.
- Comments to the Author

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论文的写作步骤

第一步：撰写论文主体部分(不包括引言)

第二步：撰写结论

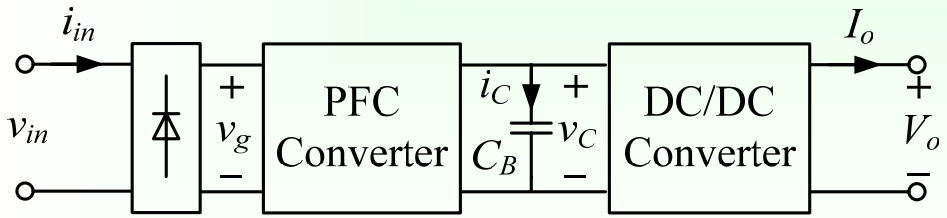
第三步：撰写引言

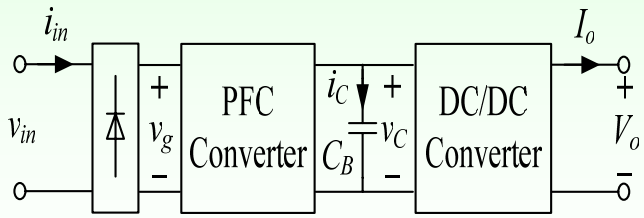
第四步：撰写摘要

第五步：确定论文题目

图形绘制的原则

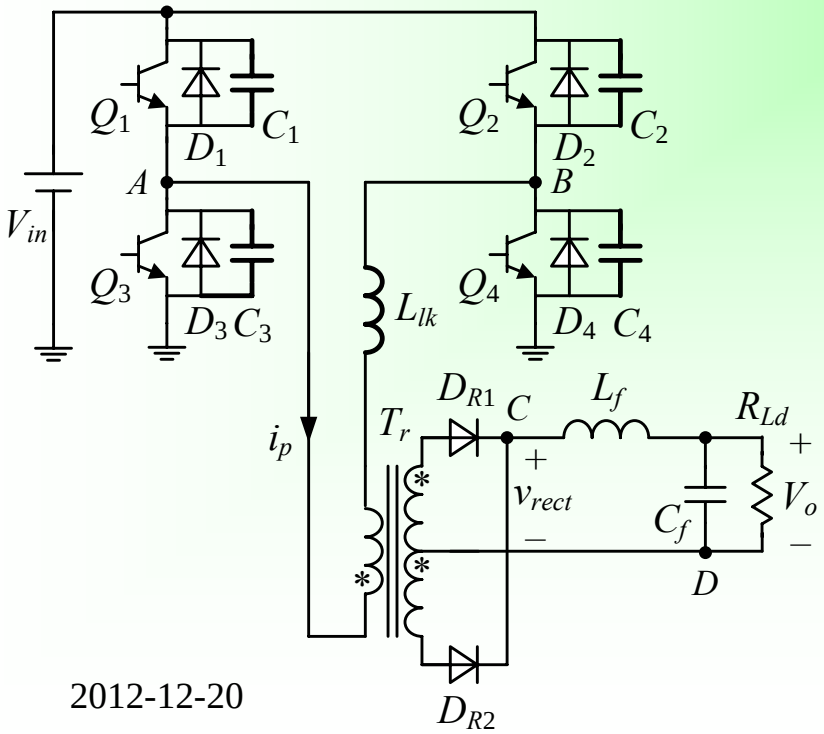
- 画图工具：Microsoft Office Visio 2003
- 图形尽量紧凑，以节约版面，同时保证缩小时字体不会太小。
- 图形应美观大方，给人的第一感觉是看到图，然后才是字符和标注，否则有喧宾夺主之虞。
- 图形放到正文中时，其字符原则上不能大于正文文字大小。画图时，建议字符和公式的字体用**Times New Roman**，字号用**10pts**，这样贴到论文中时，可以不缩小或缩小到90%。(论文正文字号一般为10pts)
- 图形缩放时，应成比例缩放，以免变形。

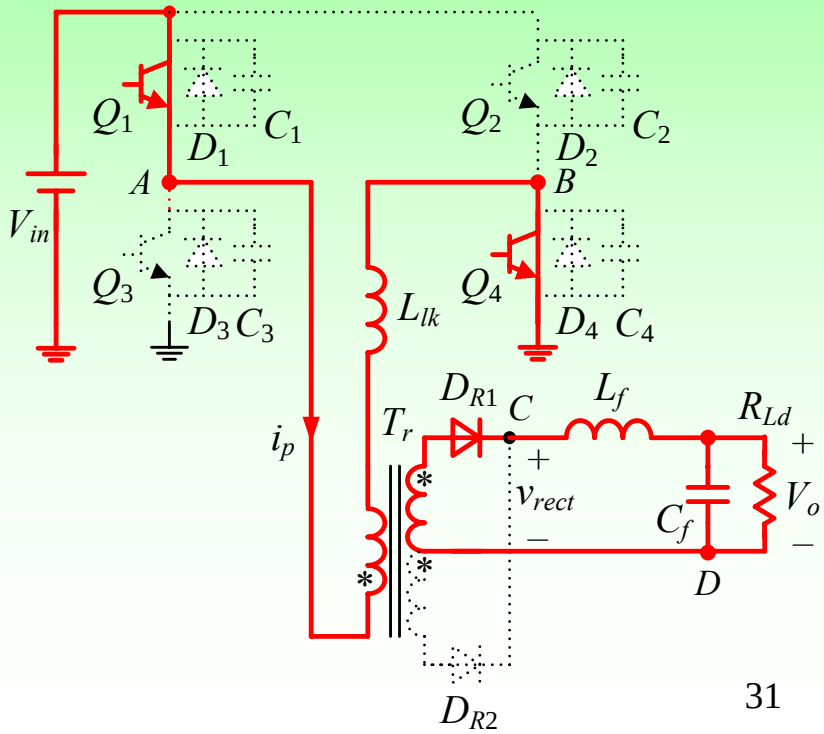




电路图的绘制

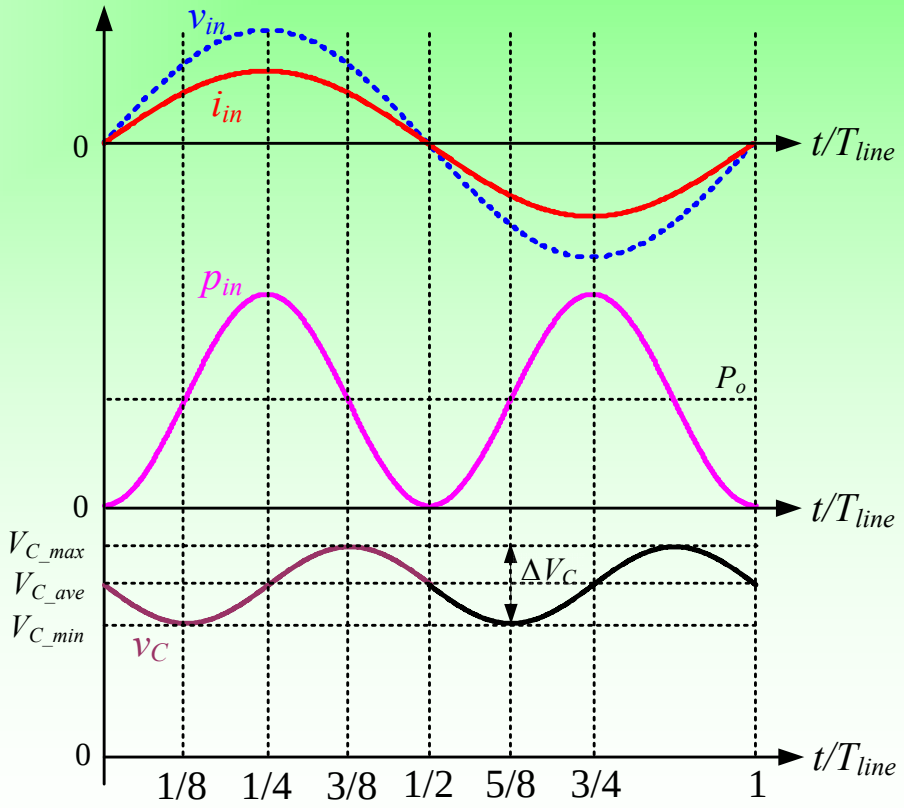
- Visio软件自带的元器件库有的不太美观，使用时也不便于自己编辑。建议自己设计元器件库。
- 一般的线条粗细选择**3pts**，强调时选择为**5pts**。
- 工作的元器件用实线，不工作的用虚线(10#线型较为美观)。





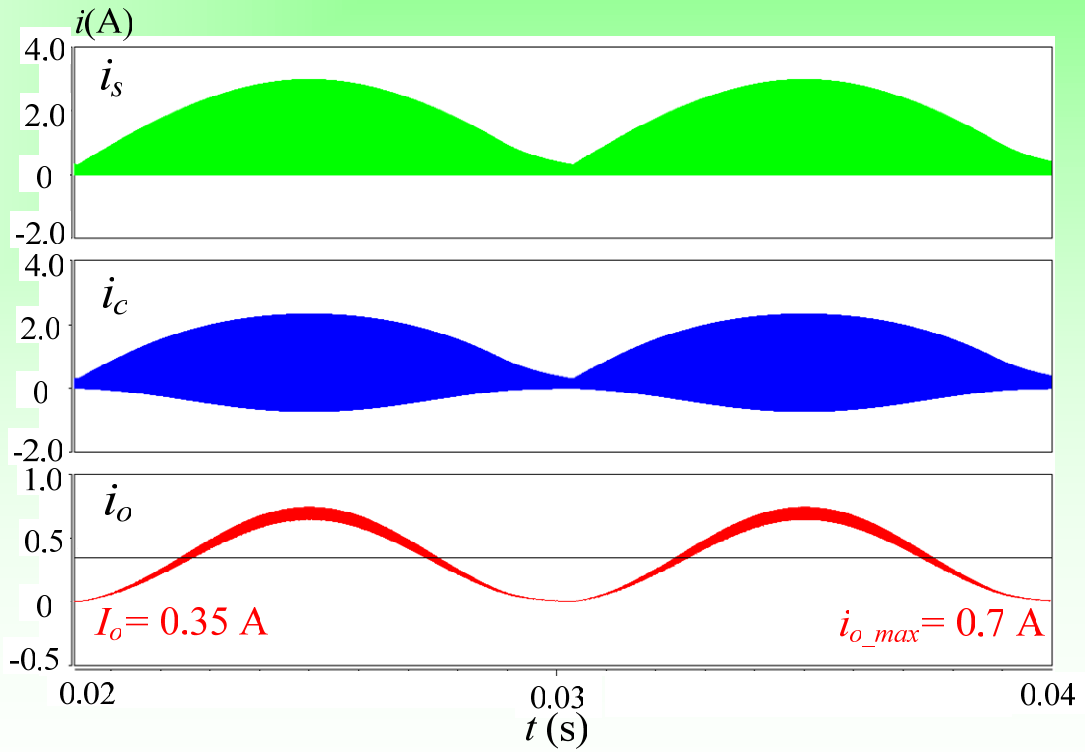
工作波形的绘制

- 直线一定要**直**，不能**斜**。
- 有规律的线型**尽量准确**，比如正弦波形，可以利用Mathcad软件绘出，再copy到Visio里编辑。
- 工作波形用**实线，5pts**；用来标注的线型用**10#虚线，3pts**。
- 工作波形的**零位**一定要标出。以便于看懂。
- 每个波形的**符号**必须标出，标注位置视具体情况而定，不一定标在纵座标处。
- 横坐标，如**时间轴**，必须标出。



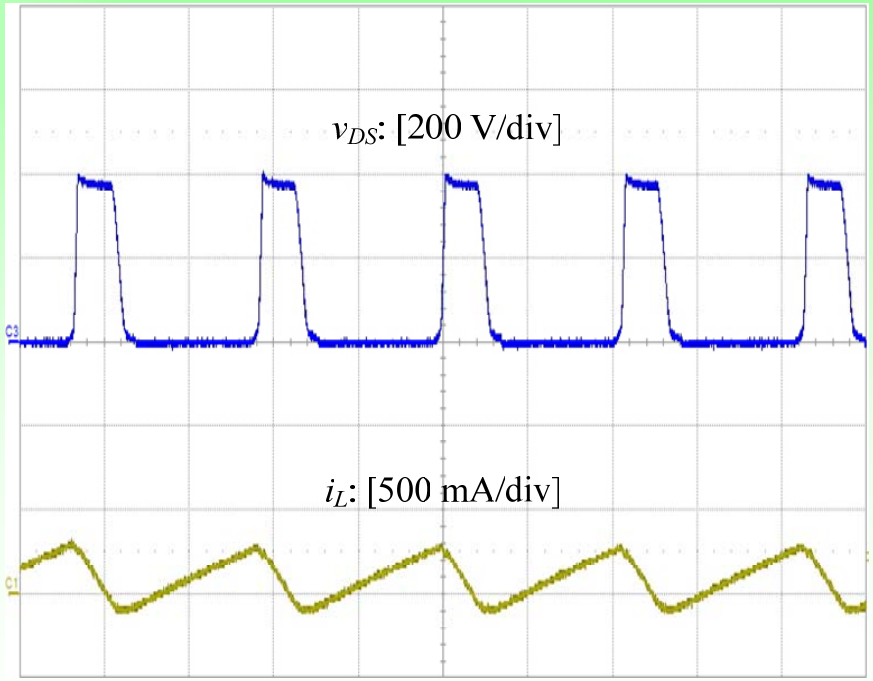
仿真波形的编辑

- 仿真或计算得到的波形或曲线，所采用的软件自身会给出相应的符号和标注的字体和大小并不一定适合直接贴在正文中，为此可以将其copy到Visio中进行处理。
- 可将波形或曲线中不必要的部分**裁减掉**，补充适当的**横坐标和纵座标刻度**。
- 波形符号可在图形的相应位置标出，原则上应在垂直方向对齐。



实验波形的编辑

- 示波器测得的波形由于探头衰减等原因，其每个波形的标尺不太直接。因此可将该图copy到Visio中进行处理。
- 可将波形中不必要的部分裁减掉，但是每个波形的零位必须保留，以便于阅读波形的幅值大小。
- 在Visio中给出每个波形的纵座标标尺，同时给出时间标尺。
- 如果波形很多，如果每个波形中都给出纵座标标尺，可能会使得字符比较拥挤，甚至会压到波形。此时波形中可不给出标尺，标尺可在图说中给出。



引言和参考文献

- 写作引言之前，应收集、整理自己**已阅读过**的相关文献。
- 阅读**拟投稿的期刊**近**2~3年**发表的论文的目录，从中找出与本文相关的文献，并仔细阅读，尽量加以引用。
- 尽量引用与本文内容相关的国际上**知名学者**的论文。
- 同一篇论文如果既发表在会议论文集中，又发表在期刊中，原则上只列出发表在**期刊上的论文**。
- 引用的参考文献尽量给予**适当的**评价和说明，并在相关处**标注**其编号。
- 除非是综述性的论文，参考文献一般列写**15~20**篇。综述性的论文参考文献数量可适当多一些。

论文写作的规范性

- 在写作之前，最好阅读几篇拟投稿期刊的论文，以了解期刊论文的大致写作方法。
- 阅读拟投期刊的投稿须知(Guidelines for Authors/Information for Authors)，了解论文投稿的格式和要求。
- 论文的题目、作者、摘要、关键词、小节题目、参考文献等的字体、大小、大小写、是否斜体等要严格按照要求。
- 有的期刊(如IEEE Transactions on Power Electronics)要求投稿的论文采用单栏、2倍行间距排版，而有的期刊(如IEEE Transactions on Industrial Electronics)要求双栏、单倍行间距排版，此时图表应放在左上角、右上角、左下角或右下角，即“顶天立地”，原则上多个图集中放在一起。

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论文的修改

- 论文投稿后，经相关审稿专家审稿后，会回馈审稿意见。对于审稿意见要认真阅读，并严格按照审稿人的意见和建议进行修改，切忌与审稿人辩论！
- 修改论文时，应在相应出用粗体或颜色标出。
- 撰写修改说明。针对审稿人的每条意见说明修改情况。语气要客气、谦虚，切不可流出不满的情绪。对于无法补充或修改的地方要尽量说明原因。修改说明要尽量简洁！
- 请记住，国际期刊的审稿人都是**Volunteer**，没有任何报酬，全是义务劳动。他们花费大量时间阅读我们的论文，并给出意见和建议，我们要心存感激。

Notes to the Reviewers/Associate Editor/Editor

The authors would like to thank the reviewers, the Associate Editor, and the Editor-in-Chief for your constructive remarks and suggestions. A revision has been carefully performed on this paper according to the suggestions provided. The following are the changes made in the revised paper.

Reviewer: 1

There are two points mentioned in the reviewer's comments, and our responses are:

1. But, a very long part of the paper is reserved for description of well known power converters. Presentation of power converters and source association rules is too basic.

Answer: We have tried to condense Section II, and have deleted Fig. 2 of the original version, so that this part becomes more concise.

2. Power rate and constraints as cost, efficiency and integration are not considered in the synthesis, while they are essential.

Answer: We have added a paragraph at the end of Section VIII (page. 18) to address the power rating and constraints as cost, efficiency and integration. However, we should stress that the aim of this paper is a circuit theoretic approach for synthesizing circuits.

Reviewer 2

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论文写作的学术道德

- 应强调**质量**，而不是**数量**。不要为了论文而写论文!
- 绝对不可以**剽窃**他人的研究成果，不可以**伪造数据**。
- 署名应按贡献大小与所有合作作者协商排序，**杜绝挂名**。
- 论文在投稿之前、审稿意见返回后、提交最终稿件和排版清样审校时，**应送所有合作作者审读和修改**，这是对合作作者的尊重，而对论文的修改也是合作作者的权利和义务。

报告内容

- 写科技论文的意义
- 科技论文的基本结构
- 国际期刊评审论文的标准
- 提高论文质量的方法
- **结语**

结语

- 论文写作是对自己研究工作的一个总结，也是研究过程的一个重要组成部分。
- 发表论文是对本领域学术界和工业界的贡献，有利于建立自己的学术地位，提升自己的自信。
- 学术论文贵在创新性，重在准确性、系统性、完整性，要清晰而简洁，尤其要注意写作规范。

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谢谢各位！

祝各位写出高质量的学术论文！