1st Lesson of

博士生第一堂研究课

60分钟科研进阶导读

PhD Research

60-minute guides for graduate students

林伟豪 著

Wei-Haur Lam

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1st Lesson of PhD Research

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感谢 Lim Sow Seng 慷慨的协助，感谢 Ahmad Safwan Sakmani、Chandra Bhushan Roy、Chen Long、Chu Yung Jeh、Cindy Soon Kong Seet、Lim Xin Le、Ng Kai Wern、 Zhao Yina、Wang Shuguang 的帮助。本书还获得国家自然科学基金创新研究群体项目（项目编号 51621092）的资助。

PREFACE

The book provides the basic guidance to conduct research. The content is based on the author's interpretation of research and his experiences, and aims to provide the guidance and help for the young researcher to develop the generic research skills. The author gives a personal interpretation of the ambiguous terms of research to allow the reader to understand the research work. He suggests the young researcher establishing good communication with supervisors in order to make opportunities grow.

A humble attitude is important in conducting research. It helps students create and contribute new knowledge to the research community in a constructive way, and slowly gain the recognition from the research community through peer-review process. Graduation on time is the utmost recognition and satisfaction during the challenging process of research training.

This book is designed for an enjoyable one hour reading with 40 short articles. The first 20 articles are of interest to those who have not started a PhD. The next 20 articles are suitable for deepening the understanding of PhD students.

Sincerely,

Wei-Haur Lam

前 言

本书为科学研究提供基本的指导。内容基于作者自己对研究的理解和科研经验，旨在为年轻的研究者们提供指导，帮助他们掌握通用的研究技巧。

作者针对模棱两可的研究术语给出了自己的见解，让读者更好地了解研究工作。作者建议年轻的研究者要和导师保持良好的沟通，从而获得更好的成长机会。

在科学研究中，保持谦卑十分重要。它有助于学生以建设性的方式为研究团队创造和贡献新的知识，并且慢慢地通过同行评议获得研究团队的认可。在充满挑战的研究训练过程中，按时毕业将是最大的认可和满足。

本书包含 40 篇短文，可为读者提供一个小时的愉快阅读。前 20 篇帮助尚未开始攻读博士研究生的读者建立科研兴趣；后 20 篇有助于博士生对科研的深化理解。

谨上

林伟豪

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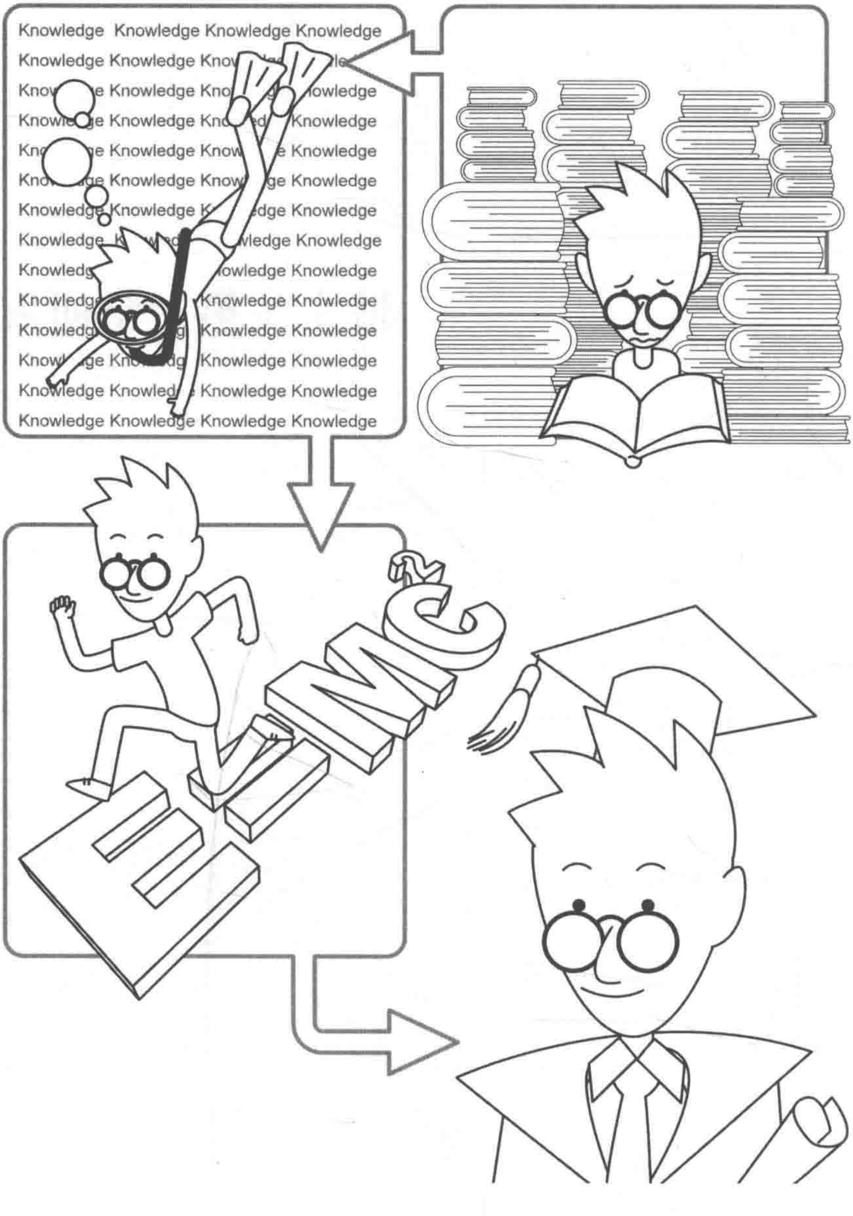


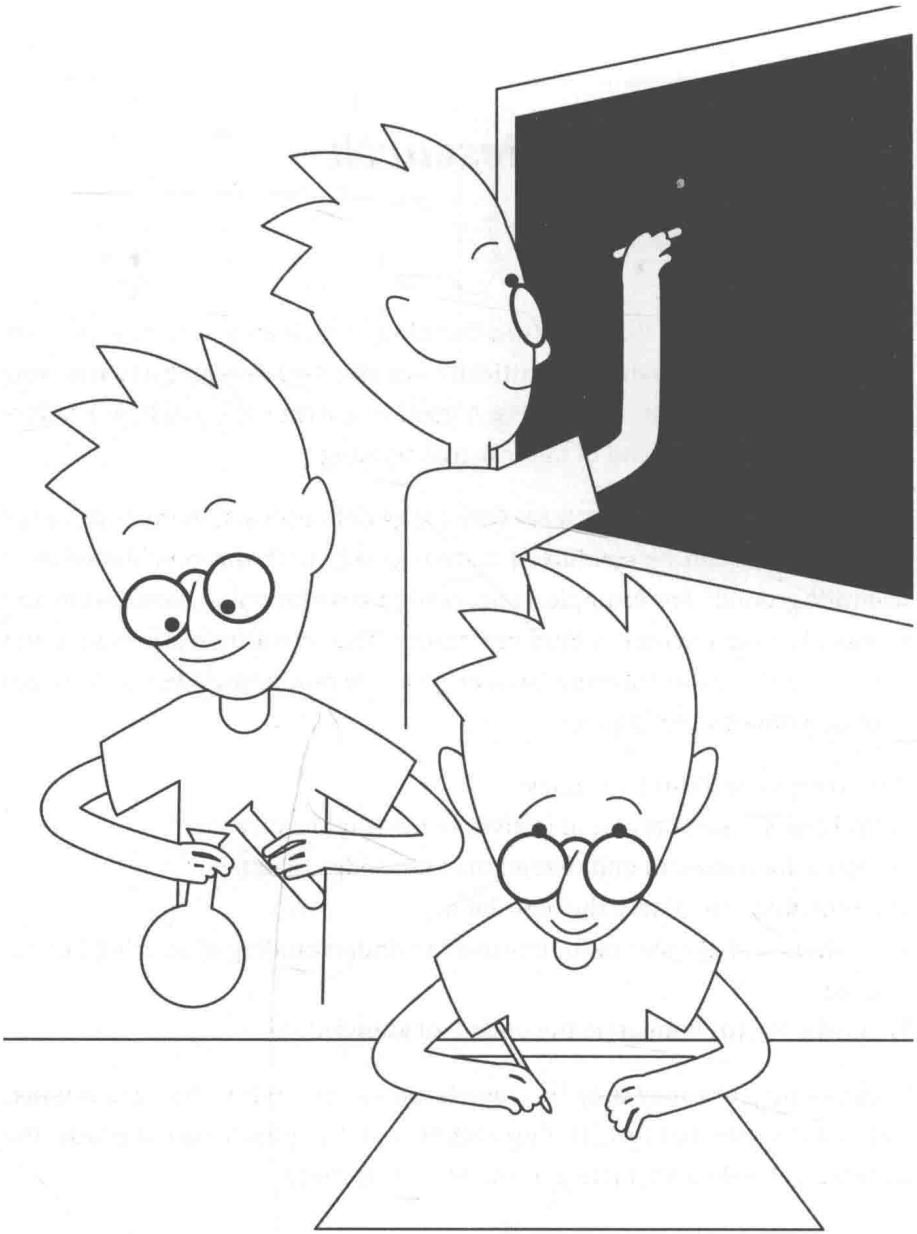
I Research

Research is training for scientific thinking, which also acts as a process to create new knowledge scientifically. An effective research creates new knowledge throughout the process. A good researcher is capable of producing good works at the end of the research training.

"Scientific" is an ambiguous term with many definitions. Generally, it means that "the work can be conducted systematically with the consideration of scientific ground". For example, conservation laws for mass, momentum and energy are fundamental in fluid mechanics. The scientific work should aim to improve these fundamental laws, or generate new knowledge in fluid mechanics without violating them.

The process of research includes:
1) Problem statements and objectives to identify the direction;
2) Literature review to understand the knowledge to date;
3) Methodology to obtain the new data;
4) Analysis and discussion to improve the understanding of existing knowledge;
5) Conclusion to summarise the update of knowledge.

Engineering work may only be considered as research if they are original and in a documented format. Research is a philosophical way of producing any kind of works systematically and with originality.



II PhD

PhD is awarded to the researcher who has completed research training in a specific field. A PhD holder should have both the generic research skills and the technical research skills. The generic skills are the soft skills to conduct research, whereas the technical skills are the ability to solve technical problems.

The generic skills include competence in database search, academic writing, conference presentation, team-working and concept of research. Technical skills include the ability to collect, analyse and discuss data to create new knowledge.

The PhD holder should be able to identify the needs of a designated community for knowledge contribution. Some of the needs include generating new ideas, transferring knowledge from other research fields or trying to integrate two different research fields to further enhance development. The candidate is required to prove that he or she possesses these skills and abilities in the PhD examination.

A two-hour oral defence is a MUST, where the quality of research based on the submitted thesis will be examined by examiners through discussion with the candidate. Three to four years of hard work will only be rewarded with a PhD after the oral defence has been passed. Students are advised to take the oral defence seriously.