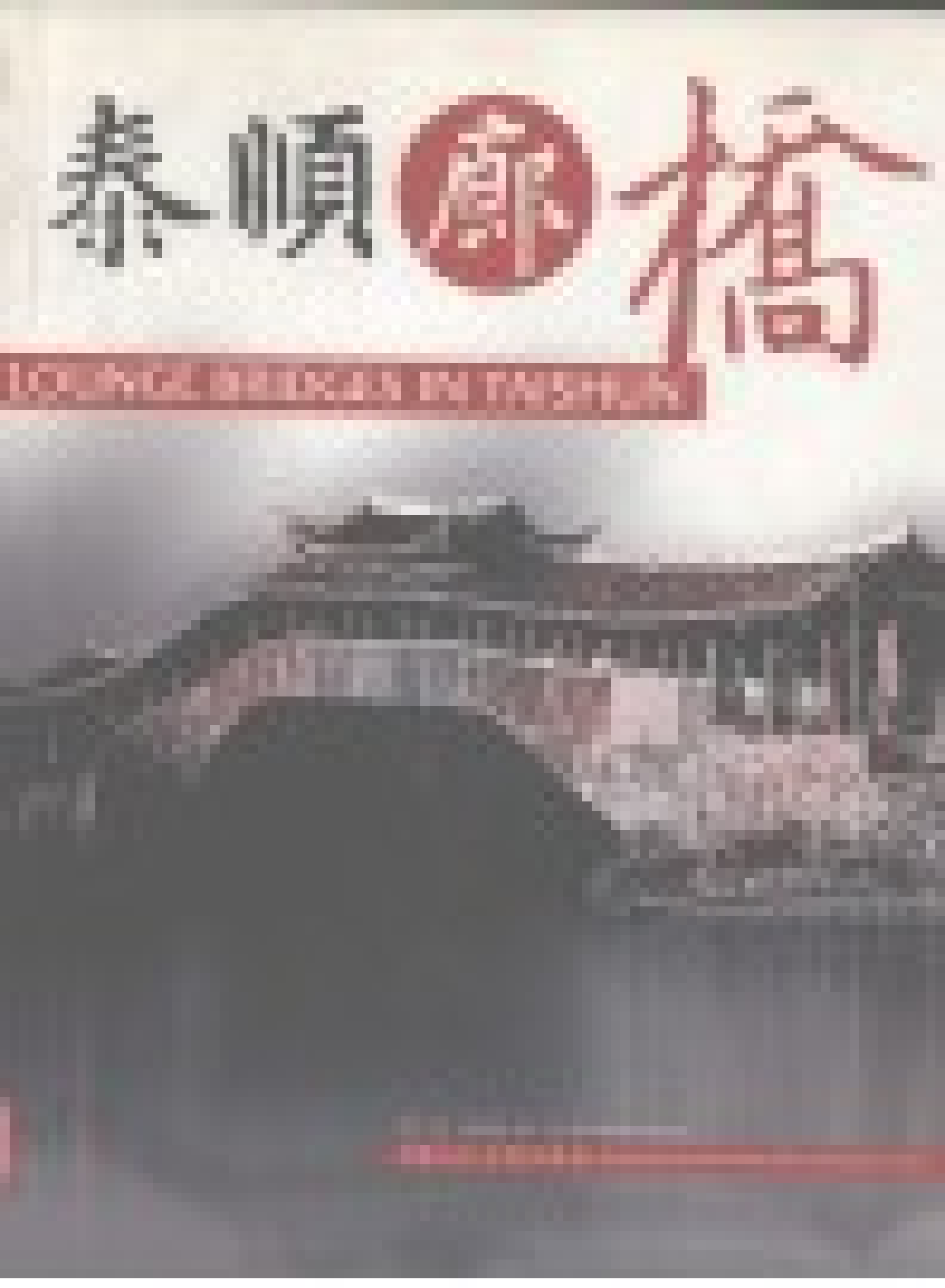
泰順廊橋

LOUNGE BRIDGES IN TAISHUN

刘 杰 沈为平 著 Liu Jie and Shen Weiping

上海人民美術出版社 SHANGHAI PEOPLE'S FINE ARTS PUBLISHING HOUSE

恭順廊橋



LOUNGE BRIDGES IN TAISHUN

泰順廊橋

刘杰 沈为平 著 Liu Jie and Shen Weiping

上海人民美術出版社 SHANGHAI PEOPLE'S FINE ARTS PUBLISHING HOUSE

图书在版编目（CIP）数据

泰顺廊桥／刘杰，沈为平著．—上海：上海人民美术出版社，2005.11
ISBN 7-5322-4471-7

Ⅰ．泰… Ⅱ．①刘…②沈… Ⅲ．风俗习惯－研究－泰顺县 Ⅳ．K892.455.4

中国版本图书馆CIP数据核字（2005）第074205号

泰顺廊桥

著　　者：刘　杰　沈为平
责任编辑：汤德伟
技术编辑：陆尧春
出版发行：上海人民美術出版社
（上海长乐路672弄33号）
开　　本：889 × 1194　1/16　13印张
印　　刷：上海中华印刷有限公司
版　　次：2005年11月第1版
印　　次：2005年11月第1次
印　　数：0001-2210
书　　号：ISBN 7-5322-4471-7/J · 4056
定　　价：118.00元

[本画册摄影者]

周咸俊 李永在 季海波 张 俊 施明达 林作贤 林上兆

江小铎 孙 斌 刘 杰 陈圣格 荣家琪 夏勤治

Mapping photographers: Zhou Xianjun, Li Yongzai, Ji Haibo, Zhang Jun,

Shi Mingda, Lin Zuoxian, Lin Shangzhao,

Jiang Xiaoduo, Sun Bin, Liu Jie, Chen Shengge, Rong Jiaqi, Xia Qinzhi.

[参与泰顺廊桥测绘者]

谭 东 王红鑫 林 浩 周 科 黄立桥 陈威廷 郑 晔 王智勇 全厚志 田静海

袁 栋 石 峰 陆雅萍 张小婷 张贤春 杨一轶等

Participants: Tan Dong, Wang Hongxin, Lin Hao, Zhou Ke, Huang Liqiao, Chen

Weiting, Zheng Ye, Wang Zhiyong, Quan Houzhi, Tian Jinghai, Yuan Dong,

Shi Feng, Lu Yaping, Zhang Xiaoting, Zhang Xianchun, Yang Yiyi, etc.

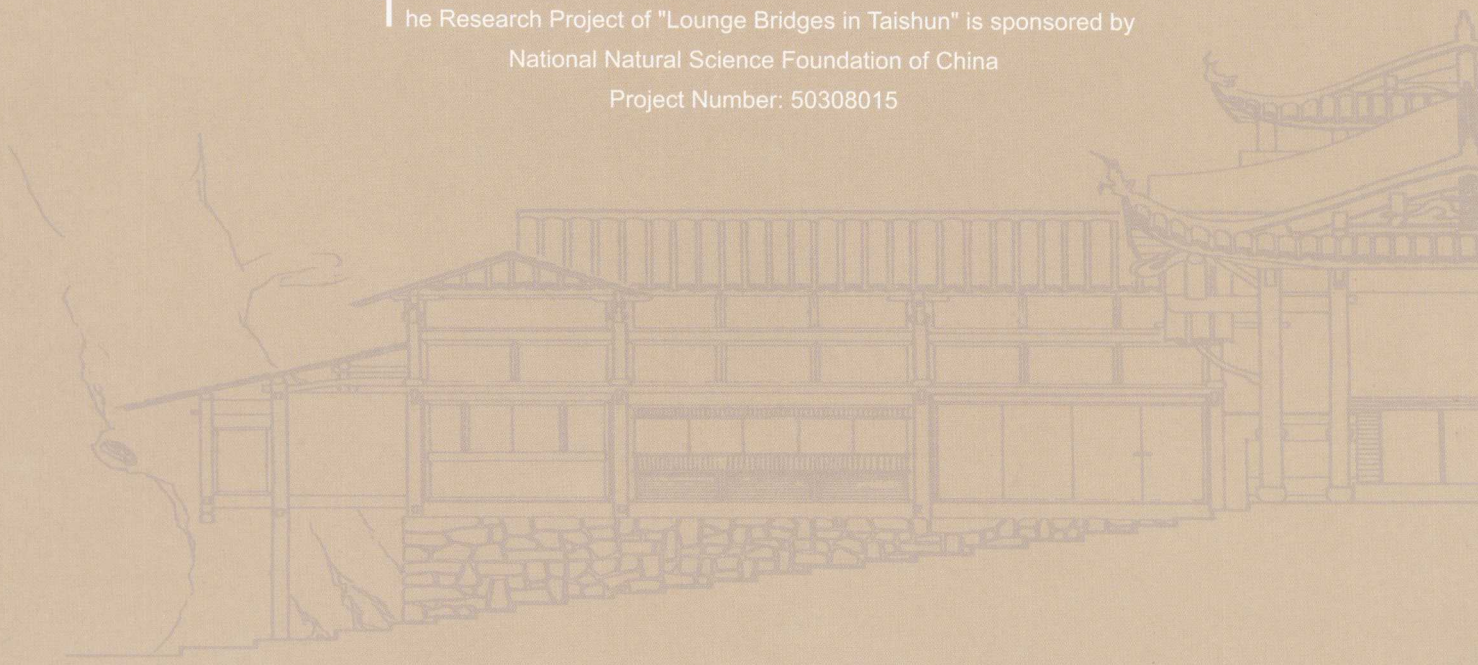
"泰顺廊桥"研究项目由国家自然科学基金资助

项目编号：50308015

The Research Project of "Lounge Bridges in Taishun" is sponsored by

National Natural Science Foundation of China

Project Number: 50308015



序

人们鉴赏非常写实的宋人名画《清明上河图》时，总是被其中的虹桥所吸引；对于行家来说，更是痴迷于它精巧的木结构。20世纪60年代，我看到甘肃遗存的类似木桥实物，具体而微地展现了千余年前的汴梁虹桥风貌，令人不胜惊喜。半个世纪之后，当我得知浙江泰顺至今犹存不少此类木桥时，更是大喜过望，双手加额，庆幸祖国的这一文化遗产没有失传。

个人孤陋寡闻，是鄙门生上海交通大学建筑学系刘杰副教授见告，才使我了解到这些先人杰作的遗存。刘杰是一位精明干练的青年学者，他尤其具备开拓精神。泰顺廊桥课题的选定和披荆斩棘的调查研究，弥补了北宋汴梁虹桥和泰顺廊桥这一领域研究的空白，就是一个证明。他正在进行的博士研究生课题——《南方地区古代木构建筑的发展》，是他进一步钻研、开辟的另一建筑史上的新领域。刘杰养成治学严谨的良好学风，在科研中认真求实，关于北宋汴梁虹桥和浙闽木拱桥的名称定位就是一例。本来唐寰澄先生在所著《中国古桥技术史》中，将北宋汴梁虹桥一类命名“叠梁木拱桥”，后来他在《中国科学技术史·桥梁卷》更名为“贯木拱桥”。刘杰对此一直怀有疑问，一次征询我的意见时，我不揣冒昧地提出拙见，认为这种结构、构造并非东汉画像砖、石上所见木桥之“叠梁”做法，而“贯木”也不够确切；准确地说，这种木拱是编起来的——其构造特点是在一排木纵梁之间用若干横梁编织。起初，我强调其形成编织的受力如梁的横木这一特点，而名之曰“编梁木拱桥”。中国力学学会副理事长、结构专家沈为平教授很认同这个“编”字，他从结构整体着眼，区别北宋汴梁虹桥和现存浙闽虹桥，与刘杰一起分别命名前者为“编木拱桥”，后者为“编木拱梁桥”，我很赞成他们的这一命名。在刘杰进行虹桥研究的过程中，沈教授不但给予了大力的支持和指导，确定了此类桥梁的名称，而且进一步参与了他的研究课题，使虹桥研究更上一层楼。《泰顺廊桥》就是他们合作的结晶，嘱我作序，不胜荣幸。

刘杰他们进行的泰顺廊桥研究还有一大特点，那就是比较注意多学科的协作。刘杰和沈为平教授的合作本身就是建筑学与结构学两大学科的结合。此外，他们还与复旦大学历史地理研究所的教授们合作，与当地的文博专家合作，所用方法已经早已超出建筑学的

Preface

One may be fascinated by the rainbow bridges in the famous Chinese painting of the realistic style titled "*Festival of Pure Brightness on the River*" produced in the Song Dynasty, but experts are more interested in the exquisite wooden structures of the bridge. I went to Gansu Province in the 1960s and saw with my own eyes the similar wooden bridges, which surprisingly represent the bridge styles of the Song Dynasty. Now half a century has passed, and when I learned that quite a few wooden bridges still exist in Taishun of Zhejiang Province, I was nevertheless surprised and felt happy about the fact that this heritage has not been lost as one of the Chinese cultural relics.

It is Mr. Liu Jie, one of my students and associate professor of the Architecture Department in Shanghai Jiaotong University, who told me of the existence of these bridges handed down from many generations. Mr. Liu is a young and energetic scholar. His groundbreaking investigation of the subject of Lounge Bridges in Taishun opens a new area in the academic field of Bianhe Rainbow Bridge in the Northern Song Dynasty and Taishun's Lounge Bridge. His doctoral subject is the "*Development of Ancient Wooden Construction in the South of China*", which is another new field in the Chinese Architectural history. Mr. Liu has a stringent academic style, as demonstrated in the denomination of Bianhe Rainbow Bridge of the Northern Song Dynasty and Zhejiang-Fujian Timber Arch Bridge. Bianhe Rainbow Bridge of the Northern Dynasty used to be denominated as "Combined Beam-Arch Bridge" in the *Chinese History of Ancient Bridge Technology* by Mr. Tang Huancheng, and later changed to "Interlocked Timber Arch Bridge" in the "Bridge" Section of the *Chinese History of Science and Technology*. Mr. Liu has doubted it and asked me for my opinion. I ventured to raise the point that this bridge is neither "combined" as in the brick paintings of the Eastern Han Dynasty nor "interlocked", but it is "woven". In other words, it is woven by several horizontal beams on top of a row of vertical beams. I denominated it as "Woven Beam Timber Arch Bridge" with a view to its mechanics similar to that of a beam of a house, which received consent from Professor Shen Weiping, Deputy Chairman of Chinese Society for the Theoretical and Applied Mechanics and structure expert, who differentiates the Bianhe Rainbow Bridge and the existing Zhejiang-Fujian Arch Bridge from the perspective of their structures, and, jointly with Mr. Liu Jie, denominates the former as "Woven Timber Arch Bridge" and the

范畴，他们还运用了历史学、社会学和文化人类学的方法。本书中就有他们与当地专家合作整理出的一些有关廊桥营造活动中的民俗研究成果。

泰顺廊桥可以说是浙闽地区木结构的代表性杰作。历史地、宏观地来看，浙南、闽北属于古闽越文化圈；扩大来说，它应属越文化体系。瓯越、闽越，追究其根源，都是发源于胶东半岛的上古东夷集团。按照不断得到考古学印证的古史传说，发源于青海高原的西部华夏集团的部族，大约在4000余年前东进，与发展壮大而西进的东夷集团相遇。东西两大原始文明的撞击，最终决战于“涿鹿之野”，以华夏集团的黄帝族战胜东夷集团的蔑帝（被黄帝族贬称为害人虫——“蚩尤”）族而告终。未归顺的蔑帝族人四散逃亡，大体上说，部分越海东渡日本，部分经赣、湘转赴西南（现在苗族仍然自称为蚩尤后代），部分向东南沿海迁移。后来江、浙地区的吴越、福建地区的闽越、广东地区的南越，直至越南，都是原始东夷集团移民的后裔。所谓“百越”，在文化上是有渊源关系的。浙南、闽北的泰顺地区，作为瓯越和闽越文化圈，是和北部的杭嘉湖地区有着历史因缘的。将近7000年前的河姆渡文化所反映的高度水准的木结构成就，表明了泰顺虹桥深远的历史文化根基。

泰顺是位于浙江省南部的一个山区县，因其地理位置的特殊，千百年来一直都受着闽越文化与瓯越文化的双重影响。这种影响，在当地保存下来的绚丽的乡土建筑中得到了淋漓尽致的展现。而在种类繁多的乡土建筑中，最具地方代表性的当数种类与数量众多的木构廊桥了。泰顺的廊桥，由于其历史之悠久，技艺之精湛，使它在中国桥梁史上占据着重要地位。只是泰顺山高路远，交通闭塞，具有重要工程技术价值、建筑艺术价值的各式木廊桥至今还不为多数人所认识。现在刘杰副教授与沈为平教授合著的此书问世，必将使泰顺廊桥扬名天下，不仅在中国桥梁史上，即使世界桥梁史上也占有十分重要的地位。

杨鸿勋

2004年9月于北京咫园

latter as "Woven Timber Arch-beam Bridge". I fully agree to their denominations. As Mr. Liu Jie is working on the subject of Rainbow Bridge, Mr. Shen has given him much support and instructionsin determining the names of the bridges, and even participates in the study of the subject. *Lounge Bridges in Taishun* is their cooperative results, so I am very happy to write this Preface for the book.

Lounge Bridge in Taishun may be said to represent the wooden structures in Zhejiang-Fujian Region. The southern part of Zhejiang and the northern part of Fujian used to be a single cultural region in Chinese history, and belong to the Yue cultural system from a macroscopic viewpoint. The ultimate origin of the people is the Pre-historic Eastern Yi Tribe in the east of Jiaodong Peninsula. Successive archeological findings reveal that it took shape in the west of Hua and Xia Tribes on the Qingzang Plateau, who came eastward about 4000 years ago, only to meet the Eastern Yi Tribe who was expanding westward. These two tribes had a battle in Zhuolu and ended up with Yellow Emperor from the west taking victory over the Mie Emperor in the east. The defeated followers of the Mie Emperor fled in all directions, some to Japan, some to Jiangxi, Hunan and then the south-west, and some to the south-east. The people now living in Jiangsu, Zhejiang, Fujian, Guangdong and even in Vietnam were descendants of the Eastern Yi Tribe. Taishun, located in the south of Zhejiang and north of Fujian Provinces, belongs to the general Ou-Yue and Min-Yue cultural circles. The highly skilled wooden structure of Hemudu Culture appearing in this region some 7000 years ago represents the historical and cultural basis for the raibow bridges in Taishun.

Taishun lies among hills on the south of Zhejiang Province. Due to its geographical reasons, it has been under the mixed influence of Min-Yue and Ou-Yue cultures. The remaining vernacular architecture in the region demonstrate how such influence works, and a large number of local-styled timber lounge bridges in various forms are the best representation of such influence. The lounge bridges in Taishun have an important position in the Chinese history of bridges due to their long history and exquisite skills. The timber lounge bridges in Taishun with high engineering values and construction values, however, have been visited by few for its remoteness and poor traffic conditions. Associate Prof. Liu Jie and Prof. Shen Weiping have jointly written this book, and will certainly make it a world-famous place with a significant position in the world history of bridge some day in the future.

Yang Hongxun

Zhi Yuan, Beijing, September 2004

前言

1997年，我当时是建筑学和土木工程合一的建筑工程系的系主任。刘杰应聘该系教职，我主持了面试。这本是系主任日常工作。不久我另有他任，离开该系，对他的印象也淡忘了。

2001年刘杰所著《泰顺》一书由三联书店出版，他特地赠我一本。当晚我翻书一阅，竟然通宵读完了这本书。我即给他打了电话感谢，并表示了对泰顺特别是廊桥的浓厚的兴趣，希望有机会随他去实地看一看。他欣然允诺。

刘杰言而有信，于翌年10月带领我等去了泰顺。实地考察之后，我对刘杰工作赞赏之余，提了三点建议。第一，重视廊桥结构的研究；第二，争取国家自然科学基金的支持；第三，介绍到国际上去。刘杰不负所望，2003年即申请到国家自然科学基金青年项目。我与之合作开展了廊桥结构的研究，成果总结成文，于2004在芬兰第八届世界木结构工程大会上作了报告。目前台湾学者，美国和日本学者已开始与他交流。

我若再年长些，当可捻须笑曰："孺子可教！"从此，我也被吸引到他的研究工作中。2003年的8月和10月以及2004年的8月，我俩又去了泰顺、寿宁、武夷山和庆元等地考察。

泰顺木拱廊桥首先吸引我的是其结构之巧妙。至迟在900年前，建桥工匠已经知道，圆木轴向抗压的能力远大于横向抗弯的能力。但是在当时用编木技术将圆木构成结构稳定的以受压为主的拱桥，真是一个划时代的发明。用现代结构力学观点我们也找不到比它更合理、更好的结构。令我欣喜不已的是在浙闽地区存有包括拱桥在内的数百座古木廊桥，其结构形式丰富多样。将它们梳理归类，可清楚地呈现木桥技术发展的脉络。更令我惊奇的是，当用计算机模拟木拱桥构造，用汴河虹桥捆扎技术代替浙闽木拱桥榫接工艺，后者第二系统中央梁长度缩短至零，自然形成了汴河虹桥的结构。由此我提出了浙闽木拱桥结构技术是在当地发展起来的；汴河虹桥和浙闽木拱桥是同一桥梁结构，适应不同地方联结技术形成的不同形式等假说。

我用头脑理性分析木拱廊桥结构之奇。同时我用心感性享受廊桥之美。2003年8月11日，我和刘杰等冒酷暑驱车前往三条桥。行至公路尽头，下车步行，烈日当空，挥汗如雨。半小时后翻过一个山岗，脚下是一条翠谷，草木葱茏，涧音淙淙，略觉凉意。千米之处，三条桥横卧山溪之上。它简洁本色，如从两侧山体中天然长出一般，与青山绿水浑然一体。我顿觉心弦受到拨动，在共鸣，在呼应。我欲凌空而去；我欲仰天长啸；我欲泪水一泻为快。当时除了包含三条桥的青山之外，世界其余部分于我已不再存在。我终于平静下来，沿鹅卵石铺就的山径，逶迤前行，进入桥内。廊屋内一片清凉世界，凉风习习，极目四望，恍若世外。

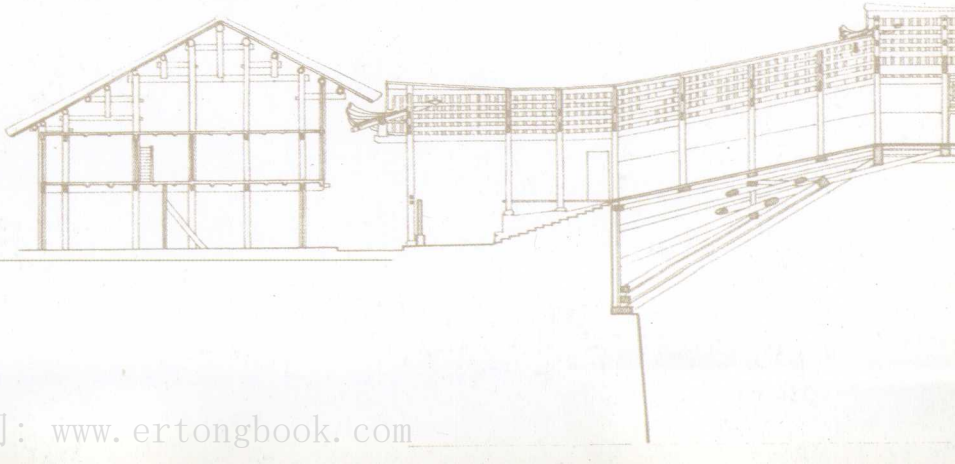
泰顺的廊桥，由于其历史之悠久，技艺之精湛，使它在中国桥梁史上占据着重要地位……

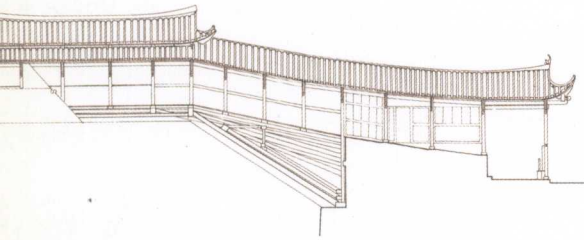
Forewords

Mr. Liu Jie had his book with the title of *Taishun* published by the JPC in 2001 and he presented me with a copy. I read it through the whole night and rang him saying thanks to him and expressed my interest in Taishun, especially the lounge bridges there, and my wish to go there some time. He gave me a positive answer.

Mr. Liu Jie kept his words, and brought me to Taishun in October the next year. By physical expedition, I made three suggestions on his work. First, he shall pay more attentions to the study of the structures of lounge bridges; second, he shall try to obtain support from National natural Scieace Founudation of China (NSFC); third, he shall publish it to the world. Liu Jie did not disappoint me and obtained the support from Young Suientisls Fund of NSFC in 2003. I made a joint study with him in the structure of lounge bridges, the result of which was a report published in the 8th World Conference on Timber Engineering in Finland in 2004. Now scholars from Taiwan, USA and Japan began to exchange ideas with him.

It is the exquisite structures of the timber arch lounge bridges in Taishun that first attracted my attention. Bridge builders began to realize that the compressive strength of a log in the axial direction is much larger than its bending strength in the transverse direction some 900 years ago at the latest. The arch bridges using woven timber technology featuring a stable compressive strength of woven timbers marked the beginning of a great age. Even modern structural mechanics will not find a better and more reasonable structure. What excited me are the multiple forms of the hundreds of bridges still existing in Zhejiang-Fujian region. To classify them in types, one may see how timber bridge technology has developed over the years. I was more excited when the joggle technology of Zhejiang-Fujian Timber Arch Bridge is replaced with the binding technology of Bianhe Rainbow Bridge, with the help of computer Simulation of the structure of arch bridge, the length of the beam at the center of system II of the former will be reduced to zero, and the structure of the Bianhe Rainbow Bridge appears. Thus I assume that the structure technology of the timber arch bridge in Zhejiang-Fujian has been developed





从此我一见不忘，渴望有幸再在她近旁滞留，或于晨曦中，或在夜月下，或当瑞雪时，或处细雨里，再度与她亲近。我在芬兰国际会议上演讲时，把她称为一座最纯粹的古桥，我的梦中情人。三条桥的美是简洁的美，协调的美，实用的美，古朴的美，它融四美于一体，构成美的磁场，感动着每一颗有灵性的心。这样的美不能用头脑理解，只能用心灵感受。

廊桥的价值不仅在于它的奇和美，还在于它的内涵之丰富。刘杰若干年来做了多方位的挖掘，对与廊桥有关的地理、人文、民俗、工艺都有了相当的研究成果积累，部分展现在本书中。

桥梁是道路和溪流、峡谷的交汇点，是道路系统的重要组成部分。如果我们把浙闽山区做成立体模型，数百座桥梁分布其中，结合古道遗存，数百年古道系统将呈现在我们面前。道路是经济和社会生活的血脉，复原的古道系统将对该地区明清历史的研究提供不可替代的参考作用。

本书中最有价值的内容之一，是为造桥工匠立传。我们这些人，头顶教授、建筑师、工程师之桂冠，备受当代社会和民众的尊重，其实不过是古代工匠的继承者。中国的传统文化，鄙薄奇技淫巧，藐视工匠之属。工匠的名字和事迹在正史中几乎空白。鲁班只留了一个名字和些许传说，李冰父子只是都江堰工程的领导者，实际的设计施工人员有谁知道，兵马俑、长城、大运河的建造者的姓名事迹无人知晓。刘杰及其合作者在十分艰难条件下挖掘收集工匠世家的资料，记录入书，留作信史，实在功德无量。面对前辈匠人的杰作，我辈作为继承人只觉汗颜，他们虽然姓名事迹湮没，但作品传世数百年至今光焰照人。而我们的成果论文有多少能历数十年而不被人遗忘。我的博士、教授、博导、理事长的头衔，相形之下只可视作顶上尘土，过眼烟云，何足道哉！

谨以本书献给所有建造了廊桥的工匠们。是年甲申，节近仲秋，皓月渐圆，遥想古人，而盼来者，是记。

沈为平

2004年9月27日于上海交通大学

locally, and Bianhe Rainbow Bridge and Zhejiang-Fujian Timber Arch Bridge are of the same bridge structure but adapted to the requirements of different local technologies.

The value of the lounge bridge lies not only in its beauty but also its rich meaning. Mr. Liu Jie has made a lot of investigations over the years and accumulated considerable fruits of study in respect of geography, humanities, folk customs, arts and crafts, part of which is reflected in this book.

Bridges are central to roads, rivers and valleys, and form an important part to road system. If we make a cubic model of Zhejiang-Fujian mountainous area where hundreds of bridges are distributed and there will appear the century old road system in front of us. Roads are pivotal to economic and social life, and a recovered ancient road system will have an irreplaceable impact on the study of the region in the Ming and Qing Dynasties.

One of the most valuable parts of this book is the biographies of the bridge builders. We are nobody but the followers of these bridge builders though we may be given such titles as professors, architects, engineers etc. and win respect from all walks of life. In the Chinese tradition, skills and techniques were not highly respected, so nearly no craftsmen were recorded in the Chinese history. Lu Ban was an exception who left us but a name and a few hearsays; Li Bin and his son were the leaders for constructing Dujiang Weirs in Sichuan and who knows the names of the designers and site workers; no records could be found about the makers of terra cotta worriers and horses, the Great Wall and the Great Canal. Mr. Liu and his cooperators collected the materials about those bridge construction families through much difficulty and incorporated them in this book. The ancient masters left us with their great achievements without leaving their names, and in comparison, will I be able to keep my contributions in research unforgettable for several dozen years? All my titles as doctor, engineer, and professor are nothing but winds and clouds.

I hereby write these Forewords and contribute this book to those who have constructed the lounge bridges. I miss the great people in the past and wish more of them to come in the future. Looking up at the moon, I see it waxing toward its fullness of the Mid-autumn Festival.

Shen Weiping

Shanghai Jiaotong University, 27 Sept. 2004

作者小传
Biographies of Authors

刘　杰

1970年生于重庆。1993年毕业于西南交通大学建筑系，毕业后进入广州佘畯南建筑师事务所工作，1998年获上海同济大学建筑历史与理论专业硕士学位。现为同济大学博士研究生，上海交通大学建筑系副教授。1995年起，开始系统地学习和研究中国传统建筑与古典园林，在国内外发表论文20余篇；同时致力于中国南方古代木构和乡土建筑的研究，出版了《泰顺》、《库村》、《中国古代建筑环境生态观》（合著）等著作。

沈为平

1946年生于上海。1969年毕业于北京航空航天大学，1982年获上海交通大学硕士学位，1986年获德国斯图加特大学博士学位。现任上海交通大学土木工程系教授，博士生导师，中国力学学会副理事长，上海市力学学会理事长。主要从事计算结构力学和结构工程研究，在弹塑性分析、高性能计算、大跨桥梁结构分析和内力影响面分析等领域发表论文60余篇，出版专著一本。

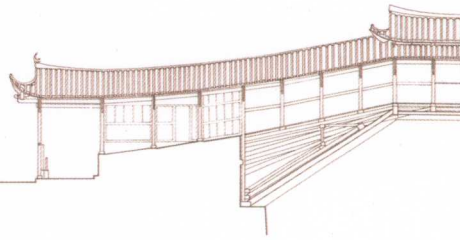
Liu Jie

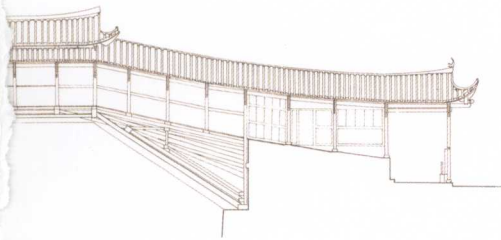
Born in Chongqing in 1970, Liu Jie graduated from Architecture Department of South-west Jiaotong University in 1993 before he worked with She Junnan Architecture Studio in Guangzhou, and was granted a master degree for architectural history and theory by Shanghai Tongji University in 1998. He is currently a PHD of Tongji University and associate professor of the Architecture Department of Shanghai Jiaotong University. He started systematic study and research of Chinese traditional architecture and classic gardening in 1995 and has published over 20 dissertations both in and outside China; he is committed to the research of ancient timber structure and vernacular architecture in southern China and has brought to press several books such as *Taishun*, *Kucun Village* and *Environmental and Ecological Ideas in Chinese Ancient Architectures* (co-authorship).

Shen Weiping

Born in Shanghai in 1946, Shen Weiping graduated from Beijing University of Aeronautics and Astronautics in 1969, and was awarded a master degree by Shanghai Jiaotong University in 1982 and a PHD degree by Stuttgart University of Germany in 1986. He is currently a professor of the Civil Engineering Department of Shanghai Jiaotong University, doctorial advisor, Vice Chairman of Chinese Society for Theoretical and Applied Mechanics, and Chairman of Shanghai Society of Mechanics. His research field ranges from computational structural mechanics to structural engineering, and has published over 60 dissertations covering a wide range of elastic-plastic analysis, high performance computing, structural analysis and internal force influence surface of large span bridges, etc. and brought to press a monograph.

目录 Contents





北涧桥
Beijian Bridge