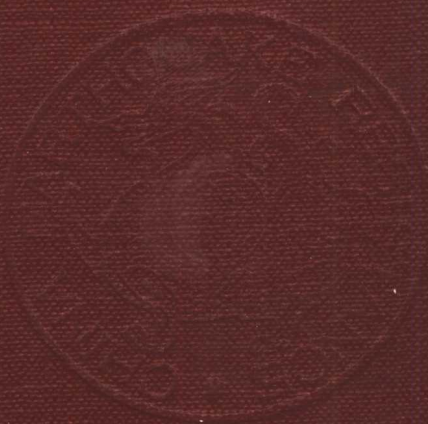


魏 琰 谢君斐 主编



中国工程抗震研究四十年

(1949—1989)

中国工程抗震研究四十年 (1949—1989)

魏 珽 谢君斐 主编

地 震 出 版 社

1989

FORTY YEARS OF RESEARCH ON
EARTHQUAKE RESISTANCE
ENGINEERING IN CHINA
(1949—1989)

Editors in Chief
Wei Lian Xie Junfei

Seismological Press

1989

内 容 提 要

本书系统总结了新中国成立 40 年来工程抗震研究方面有代表性的成果和突破性的进展,综合反映了我国工程抗震科学研究的水平。全书共七篇,包括强地面运动和场地效应,抗震分析理论和构件性能,抗震设计规范与标准,城市和工矿企业抗震防灾,抗震鉴定与加固,结构、设备与地基抗震以及试验设备、实验技术与施工技术等内容。

本书着重从总体上概括 40 年来减轻地震灾害的抗震研究诸方面的发展和进步,是一本历史文献资料,可供从事地震工程和工程抗震方面的管理、科研、教学、设计人员参考。

中国工程抗震研究四十年 (1949—1989)

魏 珪 谢君斐 主编
责任编辑:蒋乃芳 王 伟

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地 震 出 版 社 出 版

北京复兴路 63 号

国防大学第一印刷厂印刷

新华书店北京发行所发行

全国各地新华书店经售

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787×1092 1/16 22 印张 523 千字

1989 年 7 月第一版 1989 年 7 月第一印刷

印数 0001—2000

ISBN 7-5028-0279-7/TU·10

(668) 定价: 15 元

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序

中国是地震灾害严重的国家。历史上有过 1556 年关中地震死亡 80 万人的记录。在本世纪又有死亡 20 万人的 1920 年海原地震和死亡 24 万人、震惊中外的 1976 年唐山地震。至于其它震级较小、伤亡较轻但仍属灾害性的地震则不胜枚举。中国也是研究地震最早的国家。约在两千年前，张衡就发明了候风地动仪，他以此闻名全球，至今不衰。但是现代工程抗震这门学科却是在中华人民共和国建立以后才发展起来的，迄今只有 40 年历史，比起世界上的发展落后了数十年。这不能不归之于旧社会的长期动乱，政府无能，不顾人民的灾难疾苦；再则，与抗震相关的基础学科未得发展也是一个重要原因。

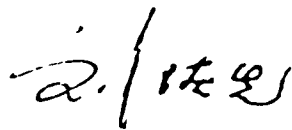
本文集由我国工程抗震战线上的老战士执笔，把我国 40 年来的抗震研究发展历史，从多个侧面作了概括的描述，公之于众，无疑会起到继往开来的作用，促进工程抗震这门学科在我国开花结果，跻身于世界先进行列，造福于人民群众。其意义是不言而喻的。

我尝把工程抗震这门学科比作一栋摩天大厦，在我国是在一个基础上由 4 根柱子支撑起来的。大厦的基础是地震危险的预测，于建国之初我们就搞了地震区划。第一根柱子是痛苦的地震经验，包括历史的和建国以后的。第二根柱子是动力学，建国时近乎空白，现在是枝繁叶茂了。第三根柱子是振动实验，我们白手起家，现在可说世界上各种实验手段，在我国也都齐备了。第四根柱子是强震观测，我们从零开始，现在已有初具规模的观测网点和数据处理系统。这四根柱子缺一就会失稳。借其支撑，我们架起了多个楼层。第一层是地震小区划，许多大、中城市都已做或正在做这项工作。第二层是一般性抗震设计规范，建国之初，我们就制定了参考性的通用草案，现在已有法律性的分类规范。第三层是特种结构的抗震设计，如高楼、高坝、反应堆、海洋平台等，这些结构的设计都需要高度的可靠性。第四层是抗震加固，我们逐年加固脆弱建筑物，防患于未然，坚持不懈，已逾 10 年历史，这无疑是减轻震灾的有力措施。第五层是重建家园，唐山的重建，在世界地震史上是独一无二的。由此可见我国这座抗震大厦已经巍然屹立。

本世纪 90 年代，联合国将在世界范围开展“减轻自然灾害十年”的活动。我国工程抗震界必然会响应这一活动，贡献我们的力量。希望在本世纪的最后 10 年里，大厦会建造得根深柱壮，直上云霄，更臻完美。为此，我想以下列短句来歌颂我们已取得的成就和灿烂的未来：

自古震灾莫奈何，
而今群起驱恶魔，
抗震之厦拔地起，
层层升空兮逼天河。

是为序。



1989. 3

PREFACE

China is a country prone to serious earthquake hazard. In the history, there had been recorded the 1556 Guanzhong Earthquake with death up to 800 thousands. In this century, again, there had occurred the 1920 Haiyuan Earthquake with death 200 thousands and the 1976 Tangshan Earthquake with death 240 thousands which shocked the country and the whole world. Those of smaller magnitude and lighter loss of lives were uncountable. China is also the earliest country pioneering seismological studies. Almost two thousand years ago, Zhang Heng discovered the first seismometer and because of that, became famous in the world till now. However, the modern science of resisting earthquake damage were not developed until the establishment of the People's Republic with a history of only forty years, lagging behind the world trend by several tens of years. This has to be attributed to the long-term societal disturbance and the incapacity of the government in old days, which leave the calamity and suffering of the people unconcerned. Another reason is that the basic sciences in connection with resisting earthquake damage have not been developed.

This volume is written by the veterans on the front of resisting earthquake damage. They give sketches of the development of researches in this field from different angles and present them to the public. Doubtlessly, this action shall succeed the former achievement and open new approaches, and promote blooming of the science of resisting earthquake in China to attain the advanced ranks in the world for welfare of the people. Its significance need not be mentioned.

The writer used to analogize the science of resisting earthquake as a high-rise building. In China, the "building" is supported on the foundation by four columns. The foundation is assessment of earthquake hazard. Early in the fifties, we have undertaken seismic zonation. The first column is the painful earthquake experiences suffered in history and after the establishment of the People's Republic. The second column is dynamics which was almost blank at the time of establishing the Republic, and now is quite flourishing. The third column is vibration test. We started from zero, but now, almost all kinds of testing are available in China. The fourth column is strong-motion observation. We developed it from nothing to a fair size of observation network with modern data processing facilities. The "building" would be unstable if either of these four columns were absent. Depending upon their support, we have laid several floors. The first floor is seismic microzonation. Microzoning map has been made or under preparation for many large and medium cities. The second floor is seismic design code. At the very beginning of our Republic, we have made drafts of a general code for designers' reference, and now legislative codes for different types of structures are available. The third floor is aseismic

design of special structures, such as high-rise buildings, high dams, nuclear reactors, off-shore platforms, etc. The design of such structures requires high degree of reliability. The fourth floor is aseismic strengthening. Every year, we have strengthened buildings and other structures weak in earthquake resistance for preventing damage ahead of events and persisted in this work for more than ten years. Definitely, this is an effective measure for mitigating earthquake disaster. The fifth floor is rebuilding of earthquake ruins. The rebuilding of Tangshan city is an unprecedented case in earthquake history. It can be seen from the above that the “building” of resisting earthquake in China has been erected up loftily.

In the nineties, the United Nations will sponsor the movement, “International Decade of Natural Disaster Reduction”. Certainly, the earthquake engineering community in China will join this project, and make our contribution. It is my hope that in the last decade of this century, our “building” shall be well constructed to satisfaction and perfection with deep foundation and strong columns and highly erected to the sky. For this, I try to use the following short phrases to praise our past achievements and the glorious future.

No way to cope the earthquake disasters in old days,
But now people arise to drive away the evil ghost,
The “building” of resisting earthquake rose from ground,
Story upon story, pile up to the sky.

This serves as the preface for the volume.

Liu Huixian
March, 1989

编辑说明

本书由建设部抗震办公室组织安排，作为庆祝中华人民共和国成立 40 周年而开展的一系列活动内容之一而编辑出版的。

我国 40 年来的工程抗震研究，经历了从无到有，研究领域从窄到宽，研究单位从少到多的发展过程。这一过程是随着国民经济建设和历次大地震的发生而逐步发展的，充分体现了从震害出发，在解决工程实际问题中发展的基本经验。50 年代，围绕着国家重点建设项目，开展了厂址选择、抗震设防和城镇基本烈度的研究；60 年代至 70 年代初，随着有关领导机构和研究机构的建立，着重开展了震害调查和抗震设计规范的研究；1976 年震惊中外的唐山大地震以来，建立了全国的抗震管理体制，健全了科研机构，国家和地方财政也拨出了相应的经费，使强震观测、抗震理论和试验研究、各抗震设计规范的编制有了明显的进展，并相继开展了现有各类工程的抗震加固、震后修复重建和提高城市综合抗震能力的研究，为尽可能减轻地震灾害与损失作出了贡献。

在庆祝中华人民共和国成立 40 周年之际，我国的地震活动又从 10 多年相对平静阶段逐步进入一个新的活跃阶段。面临严峻的震情，总结工程抗震研究的成果，供有关部门的领导和科技人员参考，必将有助于减轻地震灾害，并造福未来。

本书于 1987 年年底由建设部抗震办公室组织筹备。1988 年 8 月，由中国建筑科学研究院工程抗震研究所、国家地震局工程力学研究所和冶金工业部建筑研究总院工程抗震研究室共同主持，召开了第一次工作会议，组成了本书的审定委员会、编辑委员会和编辑组，明确了本书的编辑原则和指导思想，拟定了全书的篇目，初步落实了作者和进度。在各有关领导部门和支持下，在作者们的共同努力下，1989 年 1 月召开了本书的编审会议，协调了全书的内容，并最后完成了编写工作。

关于本书的编写原则和若干具体问题说明如下：

1. 全书力求从 7 个侧面综合反映 40 年来我国工程抗震研究有代表性的成果，重点体现我国的特点和各时期的突破性进展；

2. 各篇文章尽可能从总体上概述本领域内的代表性研究成果及存在的不同观点，而不着重于单位和个人的成果介绍，更不是只论述某个专门性问题；

3. 本书在内容上按学科适当安排，保留了各文章的独立性，故在交叉领域之间难免有所重复；

4. 一些因历史原因等尚未公开发表的重要资料未列入参考文献，仅适当注明出处，请有关同志与读者见谅。

本书在编写过程中得到了许多单位和个人支持与帮助，对此表示衷心感谢。由于编写时间仓促，书中难免有遗漏和不当之处，敬请读者批评指正。

《中国工程抗震研究四十年》编辑组

1989 年 2 月

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