

鲁 东 大 学 首 届 岩 土 与 地 下 工 程

科技研讨会论文集

岩土工程学

的 热 点 透 视

刘宝琛 孙峰华 主编



北京交通大学出版社

鲁东大学首届岩土与地下工程科技研讨会论文集

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内 容 简 介

本论文集共收录 55 篇文章, 收录的论文主要围绕以下研究领域: 边坡工程稳定性分析及加固方案研究; 隧道与地下工程设计、施工的新方法、新技术; 道路与铁道工程路基处理和加固中的新方法、新技术; 岩土及地下工程中数值计算方法; 城市环境岩土工程研究及工程实例分析。

本论文集述及的岩土与地下工程新理念、新方法、新技术、新进展在相当程度上代表了当今学科前沿发展动态, 具有很高的学术价值, 适合岩土与地下工程界专家、学者阅读。

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序 一

烟台是我国最早的沿海开放城市之一，气候宜人，经济发达，海光山色秀丽，名胜古迹众多，是中国最具魅力的城市之一。

作为鲁东大学的一员，在鲁东大学校领导的安排下，适逢烟台师范学院即将更名为鲁东大学之际，要我来筹备“鲁东大学首届岩土与地下工程科技研讨会”。

本次会议的主要议题是：

边坡工程稳定性分析及加固方案研究；隧道与地下工程设计、施工的新方法、新技术；道路与铁道工程路基处理和加固新方法、新技术；岩土工程勘察技术新进展；城市环境岩土工程研究及工程实例分析；岩土及地下工程中数值计算方法等。

会议通知发出后，得到广大同仁的大力响应，投稿甚为踊跃。整编出版的论文集中收录了 55 篇文章，作者来自铁道、公路、水电、部队、城建、矿山等多个系统。论文中述及的岩土与地下工程的新理念、新方法、新技术、新进展在相当程度上代表了当今学科前沿发展动态，具有很高的学术价值。更为值得欣慰的是，出席会议的将有隧道与地下工程专家王梦恕院士、岩土与防护工程专家顾金才院士、岩土与地下结构专家宋振骐院士等众多的工程界著名专家和学者，以及一大批工程界年轻的后起之秀。

这次盛会将使岩土与地下工程界专家、学者之间的交往更加紧密，为广大年轻一代学者提供相互交流切磋的机会。我相信这次会议的召开必将有力提升我国岩土与地下工程研究领域的整体水平。

最后，借此对出席会议的各位院士和专家们的到来表示热烈欢迎！预祝大会圆满成功！

中国工程院院士 波兰科学院外籍院士

刘宝琛

于鲁东大学院士办公室

2005-08-05

序 二

金秋送爽、气象万新。由我校特聘教授——著名岩土力学专家、中国工程院院士刘宝琛先生筹备的“鲁东大学首届岩土与地下工程科技研讨会”将于2005年10月在鲁东大学召开。出席会议的有隧道与地下工程专家王梦恕院士、岩土与防护工程专家顾金才院士、岩土与地下结构专家宋振骐院士等众多的工程界著名专家和学者。这次会议的召开适逢烟台师范学院即将更名为鲁东大学之际。

烟台师范学院位于气候宜人、经济发达、教育文化繁荣的烟台市区，学校依山傍海，环境幽雅，是求学深造的理想学府。烟台师范学院经过四十多年的发展，由一个多科性的师范院校转换成为一所学科门类齐全、师资力量雄厚、办学规模较大、教学质量较高、国际交往频繁、发展前景广阔的综合性大学。学校的发展目标是：逐步建设与发展成为适应市场经济体制和现代化建设需要、专业结构合理、综合优势明显、办学特色鲜明、办学实力较强、教学质量高、办学效益好、在同类院校中有一定影响力和竞争力的综合性大学。

实现这个发展目标，离不开工科专业的支撑。工科专业能紧密结合社会经济发展的需求，工科专业起来了，就能大大增强学校的综合实力，提高学校的社会知名度和影响力。

“岩土与地下工程”学科在我校工科专业中较有特色。岩土工程和地下工程两个学科互为唇齿、紧密相关。随着社会经济的快速发展，公路、铁路的大量建设，城市边坡与隧道施工运营，地下空间开发利用，必然产生复杂的工程环境问题，使得该学科的发展面临着前所未有的机遇和挑战。本次会议正是围绕这些前沿课题展开研讨的。

当前及今后很长的时间里，我国城市化高速发展，城区人口在急剧增多，城区既需要大修土木，又需要增加绿化，保持城市历史文化景观，改善城市生态。城市发展必然转为向地下要土地，要空间。所以，21世纪是岩土与地下空间开发利用的世纪。

本次会议的召开具有重大的社会现实意义。这次盛会为加强国内岩土工程界知名专家、学者之间的交往提供了一个平台，为广大年轻一代的学者提供了展示才华的舞台及相互交流切磋的机会。我相信这次会议的召开必将有力促进我国岩土与地下工程研究领域的蓬勃发展，也必将促进我校土木工程学科乃至整个工科专业的飞速发展。

最后，对出席会议的各位院士和专家们的到来表示欢迎和感谢！预祝大会圆满成功！

鲁东大学校长 任廷琦博士、教授

2005-08-04

序 三

我所学的专业是地理科学,对于岩土工程科学而言,是个地地道道的门外汉。由于在鲁东大学交通学院工作了几年,通过自己的学习和向同事们请教,特别是多次聆听了中国工程院院士刘宝琛先生的教诲,使我受益匪浅,对岩土工程有了一点肤浅的认识。在“鲁东大学首届岩土与地下工程科技研讨会”召开之际,也谈点自己的管见以为序三,不当之处,敬请专家学者批评指正。

众所周知,20世纪50年代,英文“Geotechnical”一词被我国学者译为“土工技术”。20世纪60年代以后,在工程研究中,不仅涉及到“土”的问题,而且还涉及到大量“岩”的问题。因此,“Geotechnical”又被称为“岩土工程”。在1991年召开的国际滑坡和岩土工程学术会议上,我国学者把“岩土工程”译为英文“Rock and Soil Engineering”。笔者认为这一译法较为科学,但是应该把“岩土工程”改称为“岩土工程学”。其原因是,“岩土工程”是一级土木工程学科的二级分支学科,把“岩土工程”改称为“岩土工程学”,最科学,最符合学科构建的一般规律。

岩土工程学是逐渐把土力学、基础工程学、工程地质学、岩体力学有机地结合在一起并应用于土木工程实际而形成的一门应用性新学科。笔者认为它的形成与发展大致经历了以下3个阶段。

① 萌芽阶段。这一阶段大致在20世纪初至20世纪60年代末,其标志是支撑岩土工程学科体系的一些基础学科,如土力学、地基基础工程学、工程地质学、岩体力学等相继形成,为岩土工程学的形成奠定了基础。

② 形成阶段。这一阶段大致在20世纪60年代末至20世纪70年代初,美国的《土力学与基础工程杂志》(Journal of Soil Mechanics and Foundation Engineering)更名为《岩土与环境工程杂志》(Journal of Geotechnical and Geoenvironmental Engineering)被视为标志。

③ 发展阶段。20世纪80年代初以来是岩土工程学的大发展时期,促使其快速发展的原因有3个:建筑规模空前扩大;现代化和城市化的快速发展将促使特殊条件下的岩土工程技术不断更新;来自人类自身生存活动产生的对岩土工程学科的挑战更加严峻。

进入21世纪,岩土工程学又有了新的发展趋势。浙江大学龚晓南先生在其论文《21世纪岩土工程发展展望》(《岩土工程学报》,2000.2)中,阐述了21世纪岩土工程学的12个研究领域及发展方向。笔者在总结其他学者研究成果的基础上认为,21世纪岩土工程学的发展主要有6大趋势:

- ① 传统意义上的岩土工程学的技术和理论将不断发展和深化;
- ② 城市岩土工程学和环境岩土工程学将得到快速发展;
- ③ 岩土工程学的一些新领域、新分支学科将不断出现;
- ④ 在以人为本思想的指导下,岩土工程学在抗震防灾中将发挥越来越大的作用;
- ⑤ 新技术、新方法的不断引用;
- ⑥ 特殊岩土工程的研究越来越多。

纵观岩土工程学的发展历程,笔者认为其经历了4次革命。20世纪60年代的“计量革命”促进了科学研究的定量化,对岩土工程学的形成起到了重大的作用;20世纪80年代的“计算机技术革命”使计算机技术得到广泛应用,从而大大提高了岩土工程学的精度计量;20世纪90年代的“信息革命”使地理信息系统在岩土工程学中得到应用,从而使岩土工程学的研究成果实现了可视化;迈入21世纪后,近几年新技术及土工合成材料的迅速发展引发了岩土工程学领域的一次科技革命,笔者称之为“土工材料革命”。岩土工程学在国内外的迅速发展,表明其具有强大的生命力和广阔的前景,致力于岩土工程学的研究大有用武之地。

鲁东大学首届岩土与地下工程科技研讨会是在刘宝琛院士的积极倡导和精心组织下召开的,并且

得到了王梦恕院士、顾金才院士、宋振骐院士等一批著名专家学者的大力支持。鲁东大学校长任廷琦博士在百忙之中为本文集作序。我谨代表鲁东大学交通学院对上述诸位先生的大力支持表示衷心的感谢！并致以崇高的敬意！

鲁东大学首届岩土与地下工程科技研讨会的胜利召开，有利于提高鲁东大学的知名度，有利于鲁东大学交通学院的对外学术交流，有利于我国岩土工程学的发展，其意义不仅是重大的而且也是深远的。“雄关漫道真如铁，而今迈步从头越。”让我们携起手来，在同一片蓝天下，共创岩土工程学的辉煌，以迎接 21 世纪知识经济时代的挑战。

孙峰华

于鲁东大学苦书斋

2005 - 08 - 16

Preface I

Yantai is one of the earliest opening coastal cities of our country. It has pleasant climate, developed economy, beautiful sea and high mountain, numerous historical sites, and it has become one of the most striking cities of China.

Under the arrangement of leaders of Ludong University, I, as a member of Ludong University, am very happy to prepare "The first scientific and technological proseminar on geotechnical and underground engineering in Ludong University". During the time of this proseminar, Yantai Normal University will be renamed as Ludong University.

The main topics of this meeting are as follows:

The study on stability and reinforcement of slope engineering; the new methods and new technology on design and construction of tunnel and underground engineering; the new methods and new technology on treatment and reinforcement of road and railway engineering; the new development in reconnaissance technology on geotechnical engineering; the study and case analysis on urban environmental geotechnical engineering; numerical calculation method of geotechnical and underground engineering, etc..

After sending out the notice of meeting, we get a lot of response of colleague and contribution. The symposium reorganized and published includes 55 articles, and the authors come from a lot of systems such as the railway, highway, water and electricity, army, urban construction, mine, etc.. The new method, new technology, new development of geotechnical and underground engineering appeared in our symposium have represent the front development trends nowadays, and to a great extent, have a very high academic value. To be more gratified is that not only a lot of famous experts and scholars, such as the tunnel and the underground project expert academician Wang Mengshu, rock and soil engineering and protecting project expert academician Gu Jincai, rock and soil and the underground engineering structure expert academician Song Zhenqi, but many younger scholars will attend the conference.

The conference will make closer contacts between famous experts and scholars in the field of geotechnical and underground engineering, and it also will offer a chance for the younger scholars to show their talents and learn from each other. I believe the convocation of this meeting will promote the integral level in the field of geotechnical and underground engineering in our country.

Finally, express welcome to the arrival of every academician and experts! Thank you very much! Wish the conference have a satisfactory success!

Member of Chinese Academy of Engineering
Foreign Member of Polish Academy of Sciences

Liu Baochen
Academician Office in
Ludong University

2005-08-05

Preface II

Golden autumn brings coolness, new phenomena takes place everywhere. "The first scientific and technological proseminar on geotechnical and underground engineering in Ludong University" held by our specially invited professor, Liu Baochen, who is a famous expert on geotechnical engineering and an academician of Chinese Academy of Engineering, will be held on October of 2005 in Ludong University. A lot of famous experts and scholars will present the meeting, such as the tunnel and the underground project expert academician Wang Mengshu, geotechnical engineering and protecting expert academician Gu Jincai, rock and soil engineering and the underground structure expert academician Song Zhenqi. During the time of this proseminar, Yantai Normal University will be renamed as Ludong University.

Yantai Normal University lies in the urban area of Yantai with pleasant climate, developed economy and prosperous education culture. Our university has a grace natural and social environment, therefore it is the ideal institution of higher learning. After more than 40 years development, Yantai Normal University will change into a comprehensive university with complete subjects, rich strength in teaching, larger teaching scale, higher educational quality, frequent international association and a bright development future. The development goal of our school is to build a comprehensive university, which adapts to the market economic system and the modernization, and also has a rational major structure, a obvious comprehensive advantage, a distinct school character, a strong school strength, a high education quality and certain influence and competitiveness among similar universities and colleges.

In order to realize the development goal, we can not achieve it without the support of industry science. The industry science can accord with the close demand for social economic development. With the development of industry science, it can strengthen the comprehensive strength of the school and improve the social popularity and influence power of the school.

The subject of "the geotechnical and underground engineering" has more characteristics in our industry science. Geotechnical engineering subject and underground engineering are closely linked, just as the lips and the teeth. With the fast development of social economy, a large number construction of railway and highway, slope and tunnel, more use of underground space will cause a lot of complicated environmental problems which will make the subject face unprecedented opportunity and challenge. This meeting just launched discussion around the front subject.

At present and in very long time in the future, the urbanization of our country will be developed at a high speed, urban population will be increasing sharply, the urban needs to not only overhaul the buildings, but also increase the virescence in order to keep the historical cultural landscape of city, improve the urban ecology. The development of city must be turned into underground to search more land and space. Therefore, the 21st century is the century that rock and soil and underground space are more developed and utilized.

This conference has significant social realistic meaning. It has offered a platform for the communication between the domestic famous geotechnical experts and scholars, and it also has offered a chance for the younger scholars to show their talents and learn from each other. I believe the conference will promote geotechnical engineering of our country and flourish the development of underground project research field effectively, and it will also promote the full-speed development of our civil engineering and industry science.

Finally, express welcome to the arrival of every academician and experts! Thank you very much! Wish the conference have a satisfactory success!

Schoolmaster of Ludong University Dr. and prof. Ren Tingqi
2005-08-04

Preface III

The speciality that I study is the geographical science, as to rock science, I am really a genuine layman. As I have worked in Transportation College of Yantai Normal University for several years, I have some superficial cognition of rock engineering science through my own learning and the consultation to my colleagues, especially the teaching of Mr Liu Baochen, who is the academician of Chinese Academy of Engineering. As the beginning of "The first scientific and technological proseminar on geotechnical and underground engineering in Ludong University", I give my humble opinion to make up this preface, and would like to ask the experts and scholars to make a comment of the impropriety place.

As everyone knows, in the fifties of the 20th century, English "Geotechnical" was translated into "土工技术" by the scholars of our country. After the sixties, it was not only involved "soil", but also "rock" during the study of engineering. Therefore, "Geotechnical" is called "岩土工程". In 1991, scholars of our country translated "岩土工程" into "Rock and Soil Engineering" at the international academic meeting on slope and geotechnical engineering. I think the translation is more suitable, while the "Rock and Soil Engineering" should be translated into "岩土工程学" instead of "岩土工程". The reason is that "岩土工程" is the second branch discipline in the first class, civil engineering discipline. So "Rock and Soil Engineering" is translated into "岩土工程学" is more scientific and more fit for the universal law of discipline structure.

Rock soil engineering is a new appliance discipline used in the reality of civil engineering which is combined with soil mechanics, basic engineering, geology engineering and rock physical engineering. I think its forming and development has experienced three stages.

① Budding Stage. This stage was about at the beginning of the 20th century to the end of the sixties, its sign was some basic disciplines of supporting the rock soil engineering discipline system have formed gradually, for instance soil mechanics, basic engineering of ground, geology engineering, rock physical engineering, etc., and established the foundation for the forming of rock and soil engineering.

② Forming Stage. This stage is about from the end of the sixties of the 20th century to the beginning of the seventies. It was the sign of that stage that "Journal of Soil Mechanics and Foundation Engineering" was renamed as "Journal of Geotechnical and Geoenvironmental Engineering".

③ Development Stage. Since the eighties of the 20th century, the rock and soil engineering has developed quickly. There are three reasons to accelerate its development: the scale of structure is expanded unprecedentedly; the modernization and fast development of the urbanization will impel the rock and soil engineering renew; because of the influence from the activity of mankind, the challenge to rock and soil engineering is more severe.

After entering 21st century, rock and soil engineering had a new development trend. Gong Xiaonan has explained 12 research fields, or development directions of rock and soil engineering during 21st century in the thesis "Forecast development of rock and soil engineering in 21st century" (Rock and Soil Engineering Journal, 2000. 2). On the basis of summarizing other scholar's research results, I think there are six main trends in the development of rock and soil engineering in the 21st century. They are: The traditional technology and theory of rock and soil engineering will be developed and deepened gradually; Urban rock and soil engineering and environmental rock and soil engineering will get fast development; New branch's discipline of some new fields on rock soil engineering will appear constantly; Under the guidance of people first, the rock

and soil engineering plays a greater role in aseismic and antidetonation measures; The quoting of new method of the new technology; The research of special rock is getting more and more.

Making a general survey of the development experience of rock and soil engineering, I think it has four revolutions. In the sixties of the 20th century, "Measuring Revolution" promoted the quantification of scientific research and played a great role in the forming of rock and soil engineering. In the eighties of the 20th century, "Computer Technical Revolution" made the technology of the computer used widely, thus the precision measuring of rock and soil engineering had been improved. In 1990s, "Information Revolution" made the geographical information system get application in rock and soil engineering, thus the research results of rock soil engineering realize being visual. After entering 21st century, the new technology and rapid development of geotechnological composite materials causes another technology revolution of rock and soil engineering in recent years, and I call that "Geotechnological Material Revolution". The rapid development at home and abroad of rock and soil engineering indicates that it has strong vitality and wide prospect, and we will have ample scope in the research of rock and soil engineering.

"The first scientific and technological proseminar on geotechnical and underground engineering in Ludong University" is held under the advocating and organizing of academician Liu Baochen and receives a lot of support of famous experts, such as academician Wang Mengshu, academician Gu Jincai, academician Song Zhenqi, etc.. The schoolmaster of Ludong University, Dr. Ren Tingqi, has made preface for the thesis. On behalf the Communication Institute of Ludong University, I show my sincerely thanks to the support of all experts and scholars! Extend the lofty compliments!

The successful convening of "The first scientific and technological proseminar on geotechnical and underground engineering in Ludong University" will improve the popularity of Ludong University, increase the foreign academic exchange of the Communication Institute of Ludong University, and help the development of rock and soil engineering of our country. It has a significant and far-reaching meaning. "The future road is endless and full of invincible barriers, we must march now from the very beginning." Therefore, we should get hands together, create the brilliance of rock and soil engineering in order to meet the challenge to the knowledge-driven economy of 21st century.

Sun Fenghua

Ku Shu Zhai in Ludong University

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