Homework for the Technical English of Civil Engineering

(TECE, 14SDC04255 / 141220)

课程编号：141220
英文名称：Technical English for Civil Engineering 土木工程专业英语
学分：2
学时：34
教师：吴兴征
要求：**请每两周完成一次作业，以要求的电子版格式发至钉钉中。**

提交所有作业的截止日期，结课周的前一周最后一次课课前。早提交者有高达 10 分的原创性加分。

HW01 Prepare a professional CV or Resume and make an introduction to yourself

Submission: your CV in English and your self-introduction *.mp3 entitled with your student number & name via DingDing talk.

HW02 Interpretation of a graph

Please design this homework by yourself and write out the description, and the topic can be extracted from the Wu's publication / our lecture notes. Alternatively, you can chose a real item from the test sample for the **CET-4/CET-6** (四六级考试真题库中的图形写作题).

给出一个专业图形，并对该图的内容用英语进行描述。(no less than 300 words)

HW03 Translate the following abstract into English

Select one of them in terms of the last digit of your student number

0301 堤防工程信息管理与风险评价系统的研究与开发

基于地理信息系统(GIS)和网络技术(Web),研究和开发分布式堤防管理系统,综合系统包括堤防信息查询子系统、堤防工程结构风险分析子系统、洪水风险子系统。系统可以方便地对堤防及保护区的各类信息进行查询,同时还可以根据历史大洪水或实时水雨情,对堤防的结构风险、洪水风险进行评估,成果数据可在 C/S 和 B/S 两种方式下进行查询、统计及展示等。

参见：解家毕，张金接，刘舒，陆吉康，吴兴征. 堤防工程信息管理与风险评价系统的研究与开发. 水利水电技术. 2007, 38(3): 69-72.

0302 中国与荷兰洪水风险分析方法的比较研究

基于洪水风险的定义,从洪灾发生概率、洪灾后果评估、风险评价指标和防洪标准经济优化决策原则等方面阐述了中荷两国在洪水风险分析研究方面的异同,初步分析了存在差别的原因以及两种方法的特点。在分别应用中国和荷兰现有风险评估方法分析安庆市堤防圈的洪水风险的基础上,探讨了将两国的风险分析方法进行整合的思路。算例表明,将堤防的工程风险与洪水本身出现的水文风险相结合,并考虑在不同洪水位下损失的差异的方法是与洪灾发生机理相符,综合考虑了各种不确定因素的、切合我国洪灾特点的一种值得进一步深入研究的新方法。

参见：王艳艳，吴兴征. 中国与荷兰洪水风险分析方法的比较研究. 自然灾害学报. 2005, 14: (4):19-24.

0303 防洪减灾科技发展现状与趋势

防洪减灾是人类社会大规模改造自然、适应自然的活动,需要有组织有计划地进行,既要遵循自然界的演变规

律,又要顺应社会经济的发展规律。防洪减灾的研究,涉及对洪水风险特性及其时空分布规律的认识,对人与自然基于洪水风险的利害关系以及水灾成灾机理的探讨,对防洪减灾体系、技术手段及对策措施的发展与完善等等。

参见：程晓陶，万洪涛，吴兴征．防洪减灾科技发展现状与趋势．中国水利. 2004, 22:31-33.

0304 公路软土地基沉降与固结分析软件系统

基于 Windows 为操作平台,采用面向对象的程序设计语言 VisualBasic 和面向对象的数据库平台 ACCESS 开发了路堤沉降和固结分析软件系统,以最直观的方式为设计和技术管理工程师服务。主要介绍系统的计算原理和功能实现,着重介绍了 MSChart 控件和数据访问对象 DAO 的使用方法。

参见：冯守旭，周玉波，吴兴征．公路软土地基沉降与固结分析软件系统．山东交通科技. 2004, 1: 26-31.

0305 棉船洲护岸试验工程

概述了棉船洲护岸工程技术试验工程立项的原由,铁塔段整治方案的选择、水上护坎工程与水下护岸工程的设计要点,以及克服开工晚、用复合土工布压盖坎脚抗风浪冲刷、在已抛石的床面上拖拉铺排等施工特点.该试验工程的实施可为崩岸整治的新材料、新技术应用提供重要依据.

参见：黄永健，赵进勇，丁留谦，张金接，吴兴征，孙东亚．棉船洲护岸试验工程．水利发展研究. 2002, 2(12):26-28.

0306 Netlon 土工网格 CE131 拉伸特性的试验研究

详细介绍不同宽度的土工网格ＣＥ１３１拉伸试验，包括试样的制备、试验现象的分析以及成果的整理与评价。指出采用无侧限的宽条拉伸试验是可行的，如何确定设计容许强度是仍待进一步探讨的问题。

参见：吴兴征，栾茂田．Netlon 土工网格 CE131 拉伸性能试验研究．大坝观测与土工测试．2000, 24(2):39-42.

0307 土工格栅拉拔试验研究进展

土工格栅是土工合成材料的一种，已较广泛地应用于加筋土建筑物中。土筋界面的参数是计算分析和设计不可缺少的参数，拉拔试验被认为能较好地反应筋材在土中的剪切性状，述评了近年来国内外拉拔试验研究的进展情况。

参见：吴兴征，丁昌杰，朱文芳．土工格栅拉拔试验研究进展．山东交通科技. 1998, (4):6-9.

0308 鱼跳混凝土面板堆石坝三维静力应力变形分析

采用邓肯模型对鱼跳面板堆石坝进行了三维有限元分析,研究软岩填筑层对坝体工作性能的影响,计算了混凝土面板与岩石填筑层的位移和应力及周边缝变形。结果表明:由于受到下游软岩填筑区的影响,坝体最大横断面最大沉降略偏向下游,总沉降量约为坝高的 1%。面板周边缝位移的绝对值一般都小于 2cm,周边缝的止水设计需注意选择合理的止水形式和填缝材料。由于坝址河谷狭窄,受岸坡约束,三维效应对坝体的应力变形影响较明显,计算结果与原型观测数值相一致。

参见：吴兴征，周晓光，徐泽平．鱼跳混凝土面板堆石坝三维静力应力变形分析．中国水利水电科学研究院院报. 2003. 1(1):75-80.

0309 土工试验教学中如何培养学生的不确定性思维

土力学试验中测得的土性指标具有较大离散性，导致学生对试验结果缺乏信心。因此，有必要探讨如何在土工试验教学中培养学生的不确定性思维。为提高教学效果，结合统计语言 R 的绘图和科学计算功能，阐述土性指标统计特性。以颗粒分析、含水量、液塑限、渗透系数、压缩系数和剪切强度

指标的多组平行试验结果为例说明不确定性的表述方法。采用概率密度分布曲线、非参数核密度估计、直方图、箱线图等对测试结果进行不确定性展示。该教学实践可以提高学生处理差异数据的综合判断与归纳能力。

参见：吴兴征，方有亮，余莉，冯震，杜二霞. 土工试验教学中如何培养学生的不确定性思维. 高等建筑教育. 2019, 28(3):122-130.

0310 基于 R 语言的岩土三轴剪切试验数据处理方法

处理三轴剪切试验数据时,需要绘制应力圆及强度包络线,进而求得包络线的回归参数,以便将这些强度参数应用于实际工程的稳定性评估中.广为采用的回归形式有线性和非线性两种,这里将测试值与预测值间的最小残差平方和作为最优回归模型的评估标准.通过非线性规划方法,求解多个描述三轴试验强度包线的数学模型,并采用 R 语言的绘图和科学计算功能进行编程实施.通过两个实例证明了算法的有效性,建议的实施方法可为三轴试验资料整理与模型参数确定提供便利.

参见：辛军霞，吴兴征，方有亮. 基于 R 语言的岩土三轴剪切试验数据处理方法. 工程质量. 2017, 35(3):71-76.

HW04 Translate the following abstract into Chinese

0411 Wu X.Z. Modelling dependence structures of soil shear strength data with bivariate copulas and applications to geotechnical reliability analysis. Soils and Foundations. 2015, 55(5):1243-1258.

Accurate estimates of the dependence of soil shear strength parameters (including cohesion and friction angle) play a crucial role in decision making by civil engineers in terms of geotechnical engineering safety. With increased site-specific information comes the need for joint soil strength models to account for the correlation characteristics between shear strength properties. In this study, using 16 sets of soil shear strength observations (consisting of 391 samples) as examples, the suitability of the dependence structure for these experimental observations is firstly identified by a goodness-of-fit test based on the Bayesian Information Criterion (BIC) with the normal, Student's t, Clayton, Frank, Gumbel, and Plackett copulas. The dependence structure between shear strength components is found to be asymmetric in most cases. Secondly, a set of paired samples of shear strength simulated from the different bivariate copulas, which contributed to various dependencies, is implemented as input for two typical geotechnical probabilistic analyses, e.g., infinite slope stability against a single sliding plane and the bearing capacity of a shallow foundation. The impact of the different choices for these dependence structures on the resulting reliability index is discussed. In both illustrative examples, the normal copula leads to an overestimation of the reliability index, whereas the Gumbel copula yields the lowest reliability index. Conservative reliability indices are obtained when the joint behaviour of the soil shear strength follows a bivariate normal distribution.

0412 Wu X.Z. Probabilistic slope stability analysis by a copula-based sampling method. Computational Geosciences. 2013, 17(5):739-755.

In probabilistic slope stability analysis, the influence of cross correlation of the soil strength parameters, cohesion and internal friction angle, on the reliability index has not been investigated fully. In this paper, an expedient technique is presented for probabilistic slope stability analysis that involves sampling a series of combinations of soil strength parameters through a copula as input to an existing conventional deterministic slope stability program. The approach organises the individual marginal probability density distributions of componential shear strength as a bivariate joint distribution by the copula function to characterise the dependence between shear strengths. The technique can be used to

generate an arbitrarily large sample of soil strength parameters. Examples are provided to illustrate the use of the copula-based sampling method to estimate the reliability index of given slopes, and the computed results are compared with the first-order reliability method, considering the correlated random variables. A sensitivity study was conducted to assess the influence of correlational measurements on the reliability index. The approach is simple and can be applied in practice with little effort beyond what is necessary in a conventional analysis.

0413 Wu X.Z. Using copulas to characterise the dependency of GCL shear strengths. Geosynthetics International. 2013, 20 (5):344-357.

The sensitivity of landfill design to shear strength variability is controlled by the measured internal shear strength of the geosynthetic clay liner and the interface shear strength between the geosynthetic clay liner and the geomembrane. Based on the Mohr–Coulomb criterion, the measured shear strength values (including the internal and interface shear strength values) depend on the cohesion and friction angle. Here, a novel and efficient mathematical tool for analysing the properties of the bivariate and the correlated geosynthetic shear strength was constructed. The arbitrary marginal probability density distribution of the componential shear strength was organised as a bivariate joint distribution with a copula function to characterise the dependency between the different shear strengths. Generally, a copula-based method provides a simple and powerful framework for modelling interdependence among variables. Thus, the construction of copulas as an alternative to correlation coefficients is addressed. In addition, the shear strength marginal distributions were described by a non-normal distribution, which was identified by the Akaike information criterion. The dependency of these margins is implemented from several empirical copulas, which were chosen from the most frequently used Elliptical and Archimedean families. The simulated correlated material properties that were generated by the copula-based sampling method were used as input values to calculate the performance of a landfill lining problem. Moreover, the computed reliability indexes were compared with the reliability indexes that were obtained by the first-order second moment method. In addition, a sensitivity study with various correlation coefficients was conducted to determine the influence of the correlation measurements on the reliability index.

0414 Wu X.Z. Assessing the correlated performance functions of an engineering system via probabilistic analysis. Structural Safety. 2015, 52(PA): 10-19.

An important issue regarding the use of probabilistic predictions for complex engineering systems is characterising the dependence structure among its correlated performance functions, which are driven by dependent or independent basic random variables. The interrelationship of these performance functions can be attributed to the same random variables and the cross correlation among the input parameters. An assessment of joint failure probability for an engineering system is proposed, which is associated with the correlated performance functions using a copula-based method by conveying the dependence structure of the performance functions. The method is demonstrated with four simple engineering problems, i.e., (a) bivariate distribution in which two predetermined performance functions are associated with each other; (b) pile bearing capacity in which the performance functions are related with the soil internal friction and the compressive strength of a concrete pile; (c) pipe flow in which the performance function of three pipes in a sewer system is assessed with six independent random variables; and (d) retaining wall in which the failure criteria for defining the performance functions include overturning failure about the toe point, sliding failure along the base, and bearing capacity instability considering uncertain soil properties. The computational efficiency is evaluated using the results based on the conventional bounding methods. The joint failure probability expressed by copulas provides a means to obtain the joint probabilities of multiple

failure modes, which pave the way for an objective description of the overall failure probability of a practical engineering problem.

0415 Wu X.Z. Geometric reliability analysis applied to wave overtopping of sea defences. Ocean Engineering. 2015, 109, 287-297.

Surge levels and waves are mutually dependent random variables, and this is reflected in their joint confidence regions or probability density contours (PDCs). The PDC generalises the concept of confidence intervals of a single variable in order to deal with multiple quantiles, so that the contour implies a geometric bound of observations falling inside it. This study introduces an efficient numerical scheme for quantifying the reliability index of a sea defence using a distance ratio of two PDCs, i.e., a dispersed PDC that just reaches the limit state surface and a one-standard-deviation PDC. The joint PDCs are defined in the original space of random variables and represented via a series of discrete vertices, which do not necessarily need to be smooth or elliptical in shape in order to fit different scattering patterns of the observations. Two numerical examples involving coastal wave overtopping problems indicate that the proposed contour-based expanding method (CBEM) provides flexibility to adopt various parametric or non-parametric joint distributions. The numerical implementation of the proposed algorithm graphically demonstrates an intuitive interpretation of the reliability index, which makes the relation between the joint PDCs and the limit state function more explicit.

0416 Wu X.Z. Development of fragility functions for slope instability analysis. Landslides. 2015, 12(1):165-175.

This paper presents a methodology for constructing fragility functions to characterise slope stability under a range of catastrophic earthquakes and rainfalls. The procedures for creating fragility functions, including the first-order reliability method (FORM) and the copula-based sampling method (CBSM), are demonstrated using a selection of typical slopes. The most common failure modes are included, such as the shallow sliding of an infinite slope, circular slip surface of a homogeneous slope, and tetrahedral wedge failure in a rock slope. Owing to the proposed approach, the fragility function can be applied to quantify the failure probabilities over a range of loading conditions with ease, as these are attributed to a function, rather than a design point. The advantage of these definitions is that the uncertainties of correlated soil shear strengths can be incorporated into the reliability models. The established procedure can provide a basis for describing vulnerable behaviour of a slope under various loading conditions and geometries.

0417 Wu X.Z. Implementing statistical fitting and reliability analysis for geotechnical engineering problems in R. Georisk: Assessment and Management of Risk for Engineered Systems and Geohazards. 2017, 11(2):173-188.

Reliability analysis and multivariate statistical fitting are valuable techniques that enhance the scientific basis of regulatory decisions in geotechnical problems. This study introduces the use of several R packages specifically developed to assist risk assessors in their geotechnical projects. Firstly, the fitting of parameterised models either to the distribution of observed samples or to characterise the dependence structures among variables, or both is presented. Secondly, the most popular reliability analysis methods, such as the first- and second-order reliability methods and the random sampling simulation method, are implemented in R. The efficiency of implementing these classical approximation methods is demonstrated through two example problems.

0418 Wu X.Z. Quantifying the non-normality of shear strength of geomaterials. European Journal of Environmental and Civil Engineering. 2018, 22(3): in press.

Geotechnical shear strength variables generally include the cohesion and angle of internal friction based upon the Mohr-Coulomb failure criterion. In this study, the non-normality of a univariate probability

density function (PDF) and the bivariate probability density contour (PDC) of observed shear strength pairs is examined for 33 geomaterial types, comprising of soils (24 types), rocks (7 types), and geosynthetic clay liners (2 types), with sample sizes ranging from 14 to 97. After a detailed analysis on the graphic features of probability density and box-whisker plots of shear strength parameters, normality testing is further quantified by skewness, kurtosis, and energy statistic tests. In most cases (23/31), distributions of cohesion are positively skewed, as are distributions of friction angle (17/29), while the distribution of these parameters is mostly platykurtic (characterised by negative excess kurtosis). Bivariate energy statistic analyses of shear strength pairs indicate that, in ten cases, p-values are below .05, demonstrating that the joint distribution differs from the bivariate normal distribution, and these results are largely consistent with those achieved by the Shapiro-Wilk test. Moreover, a slope stability analysis with different joint distributions is used to assess the impact of marginal PDFs on the failure probability.

0419 Dong P, Wu X.Z.* Application of a stochastic differential equation to the prediction of shoreline evolution. Stochastic Environmental Research and Risk Assessment. 2013, 27(8):1799-1814.

Shoreline evolution due to longshore sediment transport is one of the most important problems in coastal engineering and management. This paper describes a method to predict the probability distributions of long-term shoreline positions in which the evolution process is based on the standard one-line model recast into a stochastic differential equation. The time-dependent and spatially varying probability density function of the shoreline position leads to a Fokker–Planck equation model. The behaviour of the model is evaluated by applying it to two simple shoreline configurations: a single long jetty perpendicular to a straight shoreline and a rectangular beach nourishment case. The sensitivity of the model predictions to variations in the wave climate parameters is shown. The results indicate that the proposed model is robust and computationally efficient compared with the conventional Monte Carlo simulations.

0420 Wu X.Z. Trivariate analysis of soil ranking-correlated characteristics and its application to probabilistic stability assessments in geotechnical engineering problems. Soils and Foundations. 2013, 53(4):540-556.

An important issue in the probabilistic prediction modelling of multivariate soil properties (usually including cohesion, friction angle, and unit weight) is the measurement of dependence structure among these properties. The use of Pearson's correlation as a dependence measure has several pitfalls; therefore, it may not be appropriate to use probabilistic prediction models in geotechnical engineering problems based on this correlation. As an alternative, a copula-based methodology for prediction modelling and an algorithm to simulate multivariate soil data are proposed.

In this method, all different random variables are transformed to a rank/uniform domain in order to form a copula function by applying cumulative distribution function transformations. The technique of copulas, representing a promising alternative for solving multivariate problems to describe their dependence structure by a ranked correlation coefficient, is highlighted. Two existing observed soil data sets from river banks are used to fit a trivariate normal copula and a trivariate fully nested Frank copula. The ranking correlation coefficient Kendall's τ and the copula model parameters are estimated. The goodness-of-fit test to choose the best-fitting model is discussed.

A series of triplet samples (i.e., cohesion, friction angle, and unit weight) simulated from the trivariate normal copula with flexible marginal distributions are used as input parameters to evaluate the uncertainties of soil properties and to define their correlations. The influence of the cross-correlation of these soil properties on reliability-based geotechnical design is demonstrated with two simple geotechnical problems: (a) the bearing capacity of a shallow foundation resting on a clayey soil and (b) the stability of a

cohesive-frictional soil in a planar slope. The sensitivity analysis of their correlations of random variables on the influence of the reliability index provides a better insight into the role of the dependence structure in the reliability assessment of geotechnical engineering problems.

HW05 Group Presentation in English for Mega structures in China, Asia, Australia, European, or USA

Seven students per group (refer to GroupedListing file). The first student is the group leader otherwise another student is available. 该项作业仅需组长提交至钉钉群中即可。

Responsibilities of Team Leader:

Coordinate team meetings. If possible, have a team presentation practice before the class presentation.

You are in charge of the submission for the following documents via DingDing Talk.

(1) A PPT file in PDF format

(2) A recorded presentation in mp3 format to introduce the slides

(3) A document (in PDF format) of the introduction to each group member and the responsibilities for his subtask. You also can present the problems they are faced during the preparation for this task.

Responsibilities of Team Members:

Cooperate with your team leader regarding presentation.

Finish presentation within allocated time.

For instance, (M01) group leadership, (M02) recording mp3, (M03) preparation of the slides, (M04) gathering the materials in Chinese, (M05) gathering the image materials and translation to English, (M06) writing the text for slides, and (M07) identification of technical difficulties (or a few major issues) of the mega structure that need to be solved after completion.

Note for this Assignment

If **the last digital number** your group is matched with the followings, please choose one of Mega structures in the following area.

Groups 1, 6, - China

Groups 2, 7- Asia

Groups 3, 8 – Australia

Groups 4, 9 – Europe

Groups 5, 10 - USA

Marking criterion of this task

The assessment will be based on the following:

(a) Quality of the PPT slides.

(b) Contents of the PPT slides.

(c) Presentation skills.

Instructions

If the PPT is found to have been copied (a plagiarism), the assignment score of your group will be zero. No more than 15 pages and no less than 12 pages.

HW06 Potential homework for writing

(a) Please specify what is the most important skill in professional English learning, for instance, listening, speaking, reading, writing, and translating. Why? How to improve this skill?

(b) Please summarize or share your experience in learning Technical English for Civil Engineering.

(c) Please report an unforgettable internship professional experience and give a reasonable explanation.
(d) Write an application letter to pursue your master degree at Dundee University in the UK.
(e) Write to a web-based shop (or software company) to complain about one of its products or services.
(f) Write an essay expressing your views on an existing landmark or megastructure (such as a notable building, bridge, or other significant construction) in China or elsewhere in the world. You may include, for example, a brief introduction to the landmark or structure, as well as any technical challenges or major issues it has faced since its completion.