CONCORSO PUBBLICO, PER ESAMI, A N. 1 UNITÀ DI CATEGORIA D, POSIZIONE ECONOMICA D1, AREA TECNICA, TECNICO-SCIENTIFICA ED ELABORAZIONE DATI, PER LE ESIGENZE DEL DIPARTIMENTO DI STRUTTURE PER L'INGEGNERIA E L'ARCHITETTURA DELL'UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II (cod. rif. 2407) INDETTO CON DECRETO DEL DIRETTORE GENERALE N. 301 DEL 14.03.2024 E PUBBLICATO SULLA G.U. IV SERIE SPECIALE – CONCORSI ED ESAMI N. 25 DEL 26.03.2024

GRUPPO DI QUESITI ESTRATTI ALLA PROVA ORALE DEL 06.06.2024

GRUPPO DI QUESITI N. 5

1) Requisiti e livelli prestazionali attesi per la progettazione strutturale.

2) Il reclutamento del personale tecnico-amministrativo dell'Università.

3) Creare un nuovo documento Word
Scrivere un titolo (Calibri, 24 pt, grassetto, centrato)
Scrivere il seguente testo: "………"
Applicare il seguente stile: Helvetica, 18pt, interlinea 1.5, giustificato)
Impostate i margini del documento a 2 cm per entrambi i lati
Salvare il file sul desktop con il nome "prova"

Example 1.1

It is required to test two reinforced concrete strength models to demonstrate the principle of "over" and "under" reinforced concrete beam behavior. The available testing machine has a capacity of 45 kN and the work area to accommodate the model is approximately 0.5 × 2 m. Based on these physical limitations, a simply supported beam of up to 50 × 100 mm cross section made of sand and fine aggregate ("pea" gravel) can be fabricated using up to a No. 2 bar (6.35 mm) for the steel reinforcement. A model of the hypothetical prototype beam experiencing this behavior would be at ¼ to ⅙ scale. If only wire reinforcement of less than 6.35 mm in diameter is available, then a beam of appropriately smaller size will have to be used with a scale as small as 1/10 or 1/12. Obviously, a strength model of a larger portion of a reinforced concrete structure to be studied, using the same equipment, will have to be of a smaller cross section, hence scale.

1.7 THE MODELING PROCESS

The successful modeling study is one that is characterized by careful *planning* of the many diverse steps in the physical modeling process. An experimental study of an engineering structure is a small engineering project in itself, and as in any engineering venture, a logical and careful sequencing of events is an absolute necessity.

Detailed planning of an experiment is even more essential than planning of an analytical approach because refinement of a structural model halfway through the modeling process is usually impossible. A major aspect of planning is deciding what is expected from the model. Do we need only elastic stresses and displacements, or do we want to see how the structure behaves at overloads leading up to failure? Is instability a possible failure mode? Are thermal stresses involved? Do we have to simulate dynamic effects? The time required to complete the model study can range from perhaps a week or two for a very limited elastic model of a portion of a structure to 6 months or more for a detailed, ultimate-strength reinforced mortar model for predicting failure behavior of a complete structure. We obviously must guard against "overdoing" the model study just as we have to avoid excessive analysis of a structure. The engineer who bears final responsibility for the project must be the key person in prescribing precisely what the model is supposed to accomplish.

A typical modeling study can be broken into the following multistep process:

1. Define the *scope* of the problem, deciding what is needed from the model and what is not needed.
2. Specify *similitude* requirements for geometry, materials, loading, and interpretation of results. Pay particular attention to those similitude requirements that cannot be met, such as the desired equality of Poisson's ratio for concrete and plastics when doing elastic modeling of shell and slab structures (Chapter 2).
3. Decide on the size of model and required level of *reliability* or *accuracy*. What size model should be used consistent with the accuracy? If ±30% is adequate for design purposes, then an attempt to achieve ±10% accuracy is wasted effort and time (see Chapter 9).
4. Select model *materials* with proper attention to steps 1, 2, and 3 above (Chapters 3 through 5).
5. Plan the *fabrication* phase in consultation with the technicians who will be constructing the model, and follow the fabrication activities closely. This can be a frustrating part of modeling because it is often quite time-consuming (Chapter 6).
6. Select *instrumentation* and recording equipment for strains, displacements, forces, and other quantities. This step must be closely coordinated with steps 5 and 6, particularly if embedded strain gages are to be used in concrete models. Special strain gages and other equipment must be ordered well in advance of the actual time of usage (Chapter 7).

GRUPPO DI QUESITI N. 2

1) Modelli di capacità per il dimensionamento la verifica allo SLU per l'asta compressa snella

2) Il ruolo del Nucleo di Valutazione delle Università.

3) Creare una cartella sul desktop denominata con il proprio cognome, creare un nuovo documento con Word e salvarlo assegnandovi il proprio cognome. Nel documento Word appena creato scrivere i propri dati anagrafici: nome, cognome, data e luogo di nascita, salvare il file appena creato.

2.4 STRUCTURAL MODELS

It is a relatively simple matter to apply dimensional analysis principles to the structural model. As the discussion is developed, three types of structural models will be described. These are

1. The *true model,* which maintains *complete similarity.* Any model that satisfies each and every stipulation set forth by a proper dimensional analysis would be said to have complete similarity.
2. The *adequate model*, which maintains *"first-order" similarity.* If an engineer has a special insight into a problem, then it may be possible to reason that some of the stipulations set forth by proper dimensional analysis are of "second-order" importance. For example, in rigid-frame problems it is known that axial and shearing forces are of second-order importance relative to bending moments insofar as deformations are concerned. Thus, it may be adequate to model the moment of inertia but not the cross-sectional areas of members. Thus, any model which satisfies each and every first-order stipulation which is set forth by a proper dimensional analysis but which may not satisfy certain second-order stipulations would be said to have first-order similarity.
3. The *distorted model,* which *fails to satisfy* one or more of the first-order stipulations as set forth by proper dimensional analysis.

Of course, complete similarity is desirable in all structural models, but usually the economic and technological conditions preclude a model study that maintains complete similarity with the prototype. By neglecting certain second-order effects, it is usually possible to make an *adequate model* study to obtain results to predict the behavior of a prototype structure accurately.

2.4.1 Models with Complete Similarity

It has been seen from Buckingham's theorem that the mathematical formulation of any physical phenomenon can be reduced to an equation involving a complete set of dimensionless products,

$$\pi_1 = \phi(\pi_2, \pi_3, \ldots, \pi_n) \tag{2.35}$$

If Equation 2.35 is written once for the prototype and once for the model, the following quotient can be formed:

$$\frac{\pi_{1p}}{\pi_{1m}} = \frac{\phi(\pi_{2p}, \pi_{3p}, \ldots, \pi_{np})}{\phi(\pi_{2m}, \pi_{3m}, \ldots, \pi_{nm})} \tag{2.36}$$

where π_{1m} refers to π_1 in the model and π_{1p} refers to π_1 in the prototype, etc. Complete similarity is defined to be that condition in which all of the dimensionless products are the same in both model and prototype. When complete similarity is maintained,

$$\begin{aligned} \pi_{2m} &= \pi_{2p} \\ \pi_{3m} &= \pi_{3p} \\ &\ldots \\ \pi_{nm} &= \pi_{np} \end{aligned} \tag{2.37}$$

GRUPPO DI QUESITI N. 3

1) Tipologie strutturali per la realizzazione di edifici in calcestruzzo armato.

2) I diritti e i doveri del lavoratore.

3) Creare una cartella sul desktop denominata con il proprio cognome, creare in essa un nuovo documento Word e salvarlo assegnandovi il proprio cognome. Nel file creato scrivere la seguente frase "in data odierna ho sostenuto la presente prova pratica di informatica che prevede la seguente formattazione", impostare la seguente formattazione a tutto il contenuto nel documento: carattere Arial, dimensione 10, allineamento giustificato, colore testo Rosso.

Example 2.8

Form a complete, independent set of dimensionless pi terms from the quantities listed in Table 2.1.

The quantities and their dimensions are listed in array form as

	l	Q	M	σ	ε	a	δ	ν	E
F	0	1	1	1	0	0	0	0	1
L	1	0	−1	−2	0	1	1	0	−2
T	0	0	2	0	0	−2	0	0	0

In selecting the three independent quantities that will appear at least once in the 9 − 3 = 6 pi terms, it is evident that either mass M or acceleration a must be included, as these are the only two quantities which possess the dimension of time. The three quantities chosen here are length l, modulus E, and acceleration a. The six pi terms are then formed by inspection:

$$\pi_1 = \frac{Q}{El^2}, \qquad \pi_2 = \frac{Ma}{El^2}$$
$$\pi_3 = \frac{\sigma}{E}, \qquad \pi_4 = \varepsilon \tag{2.23}$$
$$\pi_5 = \frac{\delta}{l}, \qquad \pi_6 = \nu$$

A more rigorous treatment of dimensional independence is given in Appendix A.

2.3.3 Uses of Dimensional Analysis

Dimensional analysis can be used by the engineer in two separate ways. First, it can be useful in deducing, from experimental observations, certain theoretical results regarding the behavior of a physical phenomenon. Such a situation could arise if one knew the relevant physical variables that affected the state of some other physical variable but did not know the mathematical relationship that connected these variables. For example, if only three or four physical quantities are involved, dimensional analysis may reveal the solution to within some constant value or some unknown function of one or two variables. Rather simple experiments can then be performed to determine the constant value or the functional relationship. Of course, if there are 10 or 20 physical variables to begin with, there will still be so many dimensionless products remaining as to make experimental analysis difficult or impractical.

The second use in the area of structural design work has been stated very succinctly by Bridgman (1922):

> There are in engineering practice a large number of problems so complicated that the exact solution is not obtainable. Under these conditions dimensional analysis enables us to obtain certain information about the form of the result which could be obtained in practice only by experiments with an impossibly wide variation of the arguments of the unknown function. In order to apply dimensional analysis we merely have to know what kind of a physical system it is that we are dealing with, and what the variables are which enter into the equation; we do not even have to write the equations down explicitly, much less solve them.
>
> Suppose that the variables of the problem are denoted by X_1, X_2, etc., and that the dimensionless products are found, and that the result is thrown into the form

$$X_1 = X_2^{a_1} X_3^{b_1} \ldots \phi\left(X_2^{a_2} X_3^{b_2} \ldots, X_2^{a_3} X_3^{b_3}, \ldots\right) \tag{2.24}$$

GRUPPO DI QUESITI N. 1

1) Indagini sperimentali per la caratterizzazione meccanica dell'acciaio per l'impiego strutturale: prova a trazione; modelli meccanici per la valutazione della capacità delle membrature.

2) I cicli di studio del sistema formativo.

3) Creare un nuovo documento con Excel, comporre una tabella indicando in colonna A un elenco di 5 nominativi, in colonna B il genere (M o F), in colonna C il punteggio ottenuto e, mediante le apposite funzioni Excel, sommare i valori inseriti in colonna C, salvare e chiudere il file appena creato.

2.5.4 Structures Subjected to Dynamic Loadings

2.5.4.1 Introduction

Physical modeling of structures with dynamic loadings has steadily developed since the end of World War II (Hudson, 1967; Baker, 1973; Castoldi and Casirati, 1976; Schuring, 1977; Krawinkler et al., 1978; Harris, 1982). Time-dependent loadings, because of their complex nature and effect on structures, have placed small-scale structural model techniques on a par with analytical techniques. The dynamic loadings of interest to the structural engineer range from wind- or traffic-induced elastic vibrations to blast and impact loadings that can cause considerable structural damage. Of special interest is the problem of earthquake loading, which, because of its widespread nature and potentially devastating effects, has assumed a greater importance in our highly urbanized society.

Dynamic modeling of structures is important in education, research, and design. In education, simple laboratory experiments demonstrate basic concepts of vibrations to undergraduate and graduate students. In the area of structural research, the small-scale dynamic model has proved to be a powerful tool in extending knowledge and understanding of structural behavior in many complex situations where analytical techniques are inadequate. Also, a carefully constructed model aids the design of many dynamically loaded structures. In recent years, the quantity and the quality of the information obtained from the model test has increased as a result of improved instrumentation and data-processing systems.

The dynamics of any structure is governed by an equilibrium balance of the time-dependent forces acting on the structure. These forces are the inertia forces that are the product of the local mass and acceleration, the resisting forces that are a function of the stiffness of the structure in the particular direction in which motion is occurring, and the energy dissipation of damping forces, whether material or construction related. In addition to these forces that produce dynamic stresses and deformation in the structure, there are certain types of massive structures in which gravity-induced stresses play an important role in dynamic situations and affect modeling. The similitude requirements that govern the dynamic relationships between the model and prototype structure depend on the geometric and material properties of the structure and on the type of loading (Figure 2.9). These relationships can be derived using the pi theorem. A summary of these relationships for the most commonly encountered dynamic loads affecting civil engineering structures follows.

2.5.4.2 Vibrations of Elastic Structures

Vibration problems of elastic structures (Figure 2.9a) are very common in civil engineering practice. Traffic-induced vibrations of bridges, wind-induced vibrations of tall buildings, towers, and chimneys, rotating machinery induced vibrations in buildings, and water flow–induced vibrations of pilings and submerged structures are but a few of many such examples. These problems can be very conveniently studied by means of small-scale models. Consideration of the variables that govern the behavior of vibrating structures reveals that in addition to length (L) and force (F), which we considered in static loading situations, we must now include time (T) as one of the fundamental quantities before we proceed with dimensional analysis.

As an example, consider an elastic structure of a homogeneous isotropic material whose vibration conditions are to be determined. A typical length in the structure is designated by l and a typical force by Q. The materials of both the model and prototype can be characterized by the material constants: the modulus of elasticity E, the Poisson's ratio ν, and the mass density ρ. The important parameters to be determined from the structural vibration are the deflected shapes δ, the natural frequency f, and the dynamic stresses σ. The dimensions of the governing variables in both absolute and common engineering units are shown in Table 2.7. The acceleration due to gravity g

PER ORDINE DEL PRESIDENTE
IL SEGRETARIO DELLA COMMISSIONE
F.to dott. Pasquale PIROLLI