

TEACHING MECHANICS AS AN ENGINEERING SCIENCE IN CHINA

Yilong Bai

*State Key Laboratory of Non-linear Mechanics, Institute of Mechanics, Chinese Academy of Sciences,
Beijing 100080, PR. China*

Since Prof Tsien HS came back to China from CalTech in fifties last century, the education in mechanics has been treated as an engineering science. And the students, especially postgraduates, are trained to be between engineer and scientist, to be able to explore new fields in engineering. The main points are as follows.

1. It is an independent discipline to bridge natural science and engineering. It is not only engineering, but a guide to new trades in industry, with new concepts, theories and methods.
2. It is aimed at engineering. So, it is not so accurate and general as natural sciences. Since the objects are usually complex systems in practice, it is a necessity for the graduates to grasp the main governing mechanisms, to develop proper models and to get approximate conclusions in agreement with observations.
3. It is not aimed to a specific engineering trade, but concerns common issues in engineering. So, it must be an expanding discipline with the progress in engineering.
4. The ability building should include mathematics as a tool, natural sciences as basis, being familiar with problems and methods in engineering and being able to extract the implications from practical problems to form natural laws.

The graduate training in the Institute of mechanics, Chinese Academy of Sciences (CAS); the research classes of engineering mechanics in Qinghua University; the department of modern mechanics, University of Science and Technology of China are all the examples of such education in mechanics in China.

Take the department of modern mechanics, University of Science and Technology of China as an example. Even in fifties, the department consists of several new specializations, which are hypersonic gas dynamics, high-temperature solid mechanics, chemical hydrodynamics, explosion dynamics as well as physical mechanics. Recently, the specialization on material design was started there. These new directions make mechanics become attractive for the students.

Therefore, the students should master extensive knowledge of mathematics, physics, chemistry, namely top level courses of mathematics, physics and chemistry. The students should have a good command of applied mathematics and computations. The students should be familiar with engineering design and practice. In these aspects, a number of technical courses, like electronics, computing, engineering graphics and design, experimental mechanics, manufacturing, etc., are needed. In addition, the students should also be involved in some scientific projects outside classes.

If there are not proper textbooks on the subjects, the lecture notes were prepared by professors. "Lecture on Physical Mechanics"(1962) and "Introduction to Space Voyage" (1961) written by Tsien HS are two examples of such teaching notes of mechanics in China.

Certainly, in this way students should also learn more than traditional courses of mechanics. For instance, material physics and mechanics, statistical physics etc should be included in the list of courses.

Of course, these extensive and intensive requirements may need longer terms and may make students extremely busy. However, the graduated can become stronger and more flexible when facing new challenges in engineering.

References

- [1] Tsien HS, Engineering and engineering sciences, J Chinese Institute of Engineers, 1948, 1-14.
- [2] Zhuang FG and Zheng ZM, Tsien's thoughts on Engineering Sciences and Mechanics, 2001, Defense Industry Press, (in Chinese)

ABSTRACT

Promoted by Prof Tsien HS, the education in mechanics in China is made as an engineering science. And the graduates are trained to be between engineer and scientist. The main points are as follows.

It is an independent discipline to bridge natural science and engineering. It is not only engineering, but concerns common issues in engineering. And it is a guide to new trades in industry, with new concepts, theories and methods.

It is aimed at engineering. Since the objects are usually complex systems in practice, it is a necessity for the graduates to grasp the main governing mechanisms, to develop proper models and to get approximate conclusions in agreement with observations.

The ability building should include mathematics as a tool, natural sciences as basis, being familiar with problems and methods in engineering and being able to extract the implications from practical problems to form natural laws.