

ДИСЦИПЛІНА «MECHANICS OF COUPLED FIELDS IN MATERIALS AND STRUCTURAL MEMBERS»/

Анотація. The course is devoted to the basic principles of constitutive theories derivation making use of the framework of thermodynamics of irreversible processes. Basic fundamental results of thermodynamics are presented. A brief overview of the basic concepts and methods of continuum mechanics are given. Various concepts like temperature, heat, entropy, etc. are introduced as well. The course is confined to mechanical and heat couplings and excludes electric, magnetic, chemical and diffusion processes. Considerable attention is paid to the thermodynamic principles, the rheological models and the construction of different constitutive theories. The main approaches to construction of the models of continuum behavior on the basis of the modern concepts of thermodynamics of irreversible processes are discussed. The main attention is paid to the common features and different aspects of the material response with making use of the concepts of continua with fading memory, rate dependent materials and materials with internal state variables. To illustrate the theories capability, several examples of coupled thermomechanical response of the materials and structural elements are presented (dissipative heating of viscoelastic, elastoviscoplastic structures under cyclic loading as well as thermomechanical wave effects under thermal pulse loading of metal members)

Мета навчальної дисципліни: The aim of the course «Mechanics of coupled fields in material and structural members» is to teach the PhD student of the basic notions of the mechanics of coupled fields, to describe and simulate the effects of thermomechanical coupling under vibrations of structures and their members that are fabricated of the materials with complex physical properties as well as to teach how to derive necessary constitutive theories capable of taking account of the couplings.

Preliminary demands: PhD student has 1. *to know:* basic notions and methods of theoretical mechanics, continuum mechanics, strength of materials, heat transfer and electrostatics as well the main solution techniques; 2. *to be able to:* find solution of static, quasistatic and dynamic problems of mechanics, to solve the heat conduction problems analytically or numerically.

Змістовні модулі:

- Balance equations formulation;
- Basic notions of thermodynamics of irreversible processes;
- Thermodynamical framework of the constitutive equation derivation;
- Coupled and uncoupled thermomechanics;
- Thermomechanics of cyclic loading. Dissipative heating;
- Effects of thermomechanical couplings.

Мова викладання: English

Рік підготовки: другий рік навчання

Шифр навчальної дисципліни: ДВА 3.02.06

Кількість кредитів: 4

Форма заключного контролю: іспит

Структура навчальної дисципліни: загальний обсяг 120 годин, у тому числі 24 години аудиторних занять (18 год. – лекційні заняття, 4 год. – практичні заняття, 2 години – консультація), 96 годин самостійної роботи.

Викладач: Жук Ярослав Олександрович, чл.-кор. НАН України, проф., завідувач кафедри теоретичної та прикладної механіки механіко-математичного факультету.

Інформація про викладача:

<http://tamd.univ.kiev.ua/about-us/teachers/>

<http://www.zhuk.com.ua/>