Metal Forming

Lecture program for Mechanical Engineering students

2017/2018. academic year

1. week	The aim and scope of metal forming in mechanical engineering. Main characteristics of metal forming. The metallographical background of metal forming. Classification of metal forming processes.
2. week	The continuum mechanical theory of plasticity. The main characteristics of stress and strain state. The stress tensor, the deviator stress tensor and their main components. Principal stresses and principal directions. Stress equilibrium equations.
3. week	The strain state. Strain components and strain tensors. Principal directions and principal strains. The logarithmic (true) strain. The continuity equation, and the volume constancy rule.
4. week	The yield conditions. The Tresca-St. Venant and the Huber-Mises-Hencky yield criteria. The stress-strain relationships for elastic and plastic media. The equivalent stress and strain. The equivalent stress and strain relationships for real materials.
5. week	Some theoretical methods for solving forming problems. The specific work of plastic deformation. The general problem, and the possibility of exact solution. Approximate solution methods: the slab method, the uniform work method, the upper bound method.
6. week	Sheet metal forming. Definition and classification. Sheet metal forming by material separation: blanking, piercing operations. The deformation mechanism and the characteristics of cutted edges.
7. week	Technological process planning of blanking, piercing operations. Blank-layout and strip layout design. Determination of technological parameters. Tool design for blanking operations.
8. week	Sheet metal bending. Main types of sheet bending. The stress and strain state in bending. Determination of rectified length of bent parts. Springback in bending operations. Determination of bending force and works. Bending tool design.
9. week	Deep-draing. Classification of deep-drawing processes. Stress and strain state in deep-drawing. Determination of blank shapes and sizes. Determination of necessary drawing stages and the number of intermediate heat-treatments. Deep-drawing tools.

10. week	Bulk metal forming. Classification of bulk metal forming processes. Upsetting. Main types of upsetting. Characteristic parameters and forming limit sin upsetting. Analysis of stress and strain state of upsetting. Determination of forces and works in upsetting. Process planning by upsetting. Upsetting tools.
11. week	Extrusion and reduction processes. Classification of extrusion and reduction processes. Stress and strain state in extrusion and reduction. Design consideration in cold extrusion and reduction processes. Extrusion and reduction tools.
12. week	Forming machines classification and main types of forming machines. Mechanical presses, hydraulic presses. Selection of forming machines for forming processes.

Miskolc, September 2017.

Prof. Dr. Miklós Tisza
Head of Department