



## **Physically and geometrically non-linear structures – FE solution.**

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### **Course description:**

Development of numerical analysis and computing of structures for industry needs push forward the analysis of structures beyond its elastic limits into the physical and geometric non linear domains. Afterwards the short summary of mechanics of solid in the range of large displacements the elastic – viscoplastics behaviour of the structures will be introduced. Discussion of hypotheses of decomposition of partly elastic and inelastic strain will be presented. The comparison of numerical variants of viscoplastic laws developed nowadays will be performed and problems of their applications in the finite element method will be recalled.

### **Syllabus of the lecture**

1. Introduction
2. Summary of the solids mechanics in larges deformation range
3. Non linear behaviour of the material
  - 3.1. Decomposition of the stain tensor into elastic and inelastic part
  - 3.2. Non-linear elastic behaviour
  - 3.3. Inelastic behaviour – summary of constitutive viscoplastic models
    - 3.3.1 Formulation of constitutive viscoplastic models
    - 3.3.2. Examples of models
    - 3.3.3 Model of Perzyna
    - 3.3.4 Model of Chaboche
    - 3.3.5 Model of Bodner – Partom
    - 3.3.6 Model of Aubertin
    - 3.3.7 Model of Lehmann-Imatani
    - 3.3.8 Model of Miller
    - 3.3.9 Model of Krempl
    - 3.3.10 Model of Tanimura
    - 3.3.11 Model of Krieg, Swearengen and Jones
    - 3.3.12 Model of Walker
    - 3.3.13 Model of Korhonen, Hannula and Li



3.3.14 Model of Freed-Verrilli

3.4. Conclusions

4. Analysis of structures by the FE method

4.1. Equation of motion

4.1.1. Equation of motion and the FE method

4.1.1.1. Direct approach

4.1.1.2. Incremental approach

4.1.2. Integration methods of the equation of motion

4.1.2.1. Method of centered difference

4.2. Constituting laws integration

5. Experimentation and computing – validation of the model

<b>TERMINY WYKLADÓW</b>			
<b>Data</b>	<b>Dzień tygodnia</b>	<b>Godzina</b>	<b>Sala</b>
2014-03-18	Wt	15.00-18.00	GG 467F
2014-03-20	Cz	15.00-18.00	GG 467F
2014-03-25	Wt	15.00-18.00	GG 467F
2014-03-27	Cz	15.00-18.00	GG 467F