Tempus Project University of Kragujevac
WBCVMnet
WBC Virtual Manufacturing Network
Fostering an Integration of the Knowledge Triangle

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European Commission
TEMPUS

Name	**Modeling and optimization of production processes using the FE/FV simulation**		
Code	CTC-KG-03		
ECTS	4		
Location	CTC Kragujevac, University of Kragujevac, Faculty of Mechanical Engineering, Sestre Janjić 6, 34000 Kragujevac, Serbia		
Trainer/s	Prof. Dr Vesna Mandić (CV is in addendum)		
Purpose	New market demands in terms of price and quality of products call for the implementation of more efficient ways to design products and tools, which involves application of new CAD - technologies, modeling and FE simulation. The research and analysis of processes, its visualisation through virtual models obtained from FE simulation is proven way to increase the efficiency of design and to increase the quality of the final product. Participants of this training will have the opportunity to learn and train themselfs for the application of innovative VE technologies in product development, tools development and optimization of material processing.		
Recommended entry level	7th level of professional qualification, mechanical engineering		
Special requirements	Basic knowledge of CAD modeling and design of tools		
Duration	40 hours		
General objectives	Trainees should be able to: • explain the principles of concurent engineering • explain the importance of modeling and simulation in the design of products and processes • use a modern software tools for FE/FV simulation process • identify the relevant parameters for the optimization process • provide quality input for the FE simulation of the process (flow curves, contact friction, thermal conditions...) • interpret the results and transform them to the real processes • explain ways to optimize products and processes through a set of relevant parameters		
Topics	**1.** Engineering design **2.** Virtual engineering technologies and their integration **3.** Importance and role of modeling and numerical simulation in engineering design **4.** Role of virtual/rapid prototyping of products, tools and processes in the concurent engineering, practical demonstration **5.** Finite element/volume method **6.** Input parameters for modeling and simulation process (preprocessing), exercise **7.** Modeling of deformation processing, principles, examples, exercises **8.** Interpretation of the results of modeling and simulation (postprocessing), exercise **9.** Optimization process, the target function **10.** Optimization of processes and tools, exercises		
Specific learning outcomes in topics	**Topic 1: Engineering design**	**Number of hours**	**2**
	Trainees should be able to: • Describe the stages in the development cycle of products and processes, especially in the engineering design • Apply the recommendations for succesfull engineering design • Apply the principles of guided iteration in engineering design		
	Topic 2: Virtual engineering technologies and their integration	**Number of hours**	**2**
	Trainees should be able to: • Description of conterporary trends in the application of innovative VE technologies • Demonstrate the application and integration of different VE technologies in product development and related technological processes		
	Topic 3: Importance and role of modeling and numerical simulation in engineering design	**Number of hours**	**2**
	Trainees should be able to:		

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	• Select the method of modeling processes and „tools“ for numerical simulation • Designating the relevant process parameters • Highlight the advantages of modeling and simulation in engineering design		
	Topic 4: Role of virtual/rapid prototyping of products, tools and processes in the concurent engineering, practical demonstration	**Number of hours**	**4**
	Trainees should be able to: • Select the method for making prototypes • Select the method for reverse engineering • Describe the principles of concurent engineering		
	Topic 5: Finite element/volume method	**Number of hours**	**2**
	Trainees should be able to: • Understand the principles of finite element and finite volume methods • Choose the type of FE analysis and finite element • Interpret the results of FE/FV analysis		
	Topic 6: Input parameters for modeling and simulation process (preprocessing), exercise	**Number of hours**	**8**
	Trainees should be able to: • Use CAD importer, standard formats for the transfer of geometry • Define relevant input for the FE proces simulation • Understand the concept of flow curves, strain hardening, experimental determination • Understand the conditions in the contact of tool and workpiece, mathematical description of the contact friction and determine the friction parameters • Describe the thermal conditions of the process • Succesfull use of FE/FV software postprocessor for entry of input data		
	11. Topic 7: Modeling of deformation processing, principles, examples, exercises	**Number of hours**	**6**
	Trainees should be able to: • Model different processes of deformation using FE/FV software • Define relevant process parameters, which should be modified in the course of numerical analysis • Succesfully use VM software for numerical simulation		
	Topic 8: Interpretation of the results of modeling and simulation (postprocessing), exercise	**Number of hours**	**4**
	Trainees should be able to: • Interpret the results of FE/FV analysis process and transform them to the real processes • Do a detailed analysis of the results of simulation and suggest corective measures • Succesfully use postprocessor in FE/FV software for overview of results		
	Topic 9: Optimization process, the target function	**Number of hours**	**2**
	Trainees should be able to: • Optimize design solution through numerical FE/FV simulation • Identify influential parameters of the process, define a plan of „numerical experiment“ • Understand the concept of target function optimization, making the right choice		
	Topic 10: Optimization of processes and tools, exercises	**Number of hours**	**8**
	Trainees should be able to: • Independently optimize processes of deformation using FE/FV simulations • Correct geometrical parameters of tools and process parameters to meet the target function optimization • Find ways to use VM technologies in domestic environment		
Portfolio assessment	Trainer evaluates level of succes in overcoming the training of each student, through assessments exercises and testing. **Rating exercise:** Exercise trainer defined on the basis of which can be implemented to assess the degree of learning outcomes. The exercises can be performed individually or in team, in groups of 2-5 trainees. **Examination:** Test is defined by trainer on basis of examination which can assess the cognitive skills and their application. For this purpose it is necessary to respond to a range of questions. Answers to questions are provided in writing and orally, in a conversation with		

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trainer evaluator.

Evaluation: Meet 50 - 64%
Successful 65 - 79%
Excellent 80 - 100%

Performance criteria and the percentage of representation of these techniques in the evaluation module will be given later.