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* Course Name	Chinese			
	English Simulation Theory and System Analysis of Metal Forming Process			
* Credits	3	* Teaching Hours	48 1 =16	
* Semester	Spring	* Cross-semester?	No	Spanning over Semesters
* Course Type	Program Elective Course	* Course Type	For full-time students	
* Course Category	Specialized Course	Targeting Students	Doctoral Level	
* Instruction Language	Chinese	Teaching Method	In class teaching	
* Grade	Letter grading	Exam Method	Essay	
* School	050 School of Material Science and Engineering			
Subject	Material Science and Engineering			

Person in charge	Name	ID	School	E-mail
	CHEN Jun		School of Material Science and Engineering	jun_chen@sjtu.edu.cn

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* ( ) Course Description	( ) 1 2 3 4 5
* English Course Description	Course introduction: In this course, we will introduce plasticity models, deformation theory based variational principle, flow theory based variational principle, small deformation based elasto-plastic FEM, large deformation based elasto-plastic FEM, rigid plastic FEM, the key technologies for the implementation of numerical simulation, engineering applications of numerical simulations by elasto-plastic FEM and rigid-plastic FEM. This course is an important fundamental course for numerical simulation of metal forming processes. Course objectives: (1) Understand different methods for metal forming process numerical simulation and relevant fundamentals of mathematics and mechanics; (2) Grasp the fundamental theories of elasto-plastic FEM and rigid-plastic FEM; (3) Understand the plasticity models and the methods to determine their parameters; (4) Get to know the state-of-the-art about metal forming process numerical simulation and the future trends; (5) Build the capability to use commercial software tools for metal forming process numerical simulation.

* ( ) Syllabus	1 3 + 2 3 + 3 3 + 4 6 + 5 3 + 6 6 + 7 3 + 8 6 + 9 6 + 10 3 + 11 3 + 12 3 +
* English Syllabus	Chapter 1 Background of metal forming technologies and fundamentals of numerical simulation; 3 teaching hours (TH); In-class teaching and discussion Chapter 2 Calculus of variations about plastic deformation and flow law; 3 THs; In-class teaching and discussion Chapter 3 Small deformation theory-based elasto-plastic finite element method; 3 THs; In-class teaching and discussion Chapter 4 Finite deformation theory-based elasto-plastic finite element method; 6 THs; In-class teaching and discussion Chapter 5 Rigid visco-plastic finite element method; 3 THs; In-class teaching and discussion Chapter 6 Flow stress model, yield function, hardening model, forming limit curve and ductile fracture criterion and parameter calibrations; 6 THs; In-class teaching and discussion Chapter 7 Framework of numerical simulation system and advanced development; 3 THs; In-class teaching and discussion Chapter 8 Key technologies for rigid visco-plastic FEM implementation; 6 THs; In-class teaching and discussion Chapter 9 Key technologies for elasto-plastic FEM implementations; 6 THs; In-class teaching and discussion Chapter 10 Numerical simulation applications of rigid visco-plastic FEM; 3 THs; In-class teaching and discussion Chapter 11 Numerical simulation applications of elasto-plastic FEM; 3 THs; In-class teaching and discussion Chapter 12 Cutting edge questions on metal forming technologies and numerical simulation; 3 THs; In-class teaching and discussion
* Requirements	10-15
* English Requirements	Grading: In the last week, each student shall make a 10-15 minute presentation related with the course. After the course is finished, each student shall submit an review report or an academic report/article related with the course within 2 months.
* Resources	[1] 1999 [2] 1990 [3] 1989 [4] 1989 [5] 1997 [6] 2005 [7] 1988 [8] S. Kobayashi, S.I. Oh, T. Altan. 1989, Metal Forming and the Finite Element Method, Oxford University Press [9] J. Hallquist, 2006, LS-Dyna Theory Manual, www.lstc.com
* English Resources	[1] PENG Yinghong, 1999, Numerical Simulation Technologies for Metal Forming Processes, Shanghai Jiao Tong University Press [2] QIAO Duan and QIAN Rengen, 1990, Nonlinear Finite Element Method and Its Applications in Plastic Forming, Metallurgical Industry Press [3] LV Liping, 1989, Finite Element Method and Its Applications in Forging Process,

	Northwestern Polytechnical University Press [4] CHEN Ruxin, HU Zhongmin, 1989, Plastic Finite Element Method and Its Applications in Metal Forming Processes, Chongqing University Press [5] ZHONG Zhihua, LI Guangyao, 1997, Computer Simulation and Application of Sheet Metal Forming Process, Beijing University of Technology Press [6] LIN Zhongqin, 2005 Numerical Simulation of Auto Panel Stamping Processes, Mechanical Engineering Press [7] JIANG Youliang, 1988, Nonlinear Finite Element Method, Beijing Institute of Technology Press [8] S. Kobayashi, S.I. Oh, T. Altan. Metal Forming and the Finite Element Method, Oxford University Press, 1989 [9] J. Hallquist, LS-Dyna Theory Manual, www.lstc.com, 2006
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