



University of Tehran
School of Civil Engineering

Course:	8102415 - Contact Mechanics		
Course type:	Optional		Credit: 3
Level:	PhD		
Co-requisite(s):	-		
Prerequisite(s):	Finite Element Method Plasticity		
Prerequisite by topic:	-		
Textbook(s):	[1] Discontinuum Mechanics; S. Mohammadi, WIT Press, 2003. [2] Computational Contact Mechanics; P. Wriggers, Wiley, 2002. [3] Contact Mechanics, K.L. Johnson, Cambridge University Press, 1985. [4] The Combined Finite/Discrete Element Method, A. Munjiza, Wiley, 2004.		
Coordinator:	S. Mohammadi, Professor of Computational Mechanics, School of Civil Engineering		
Goals:	The main objective is to provide the theoretical and numerical bases for the complex subject of computational contact mechanics. It covers both the fundamental theoretical basis as well as the basics and applied computational issues of normal and frictional contacts in conforming and non-conformal multiple contact problems.		
Outcome:	1. A historical review contact problems 2. Continuum contact versus discontinuum contact 3. Constraint enforcement methods 4. Normal contact formulation 5. Frictional contact formulation 6. Multiple contacts and Discrete element method (DEM) 7. Fracture and localization		
Topics:	1. A historical review of contact problems 2. Constraint enforcement techniques <ol style="list-style-type: none"> a. Mechanical/mathematical definitions of constraints b. Penalty method c. Lagrange method d. Perturbed Lagrangian method e. Augmented Lagrangian method f. Contact instability 3. Normal contact <ol style="list-style-type: none"> a. Normal contact constraint b. Node to node and node to face contacts c. Hydrocodes 		

	<ul style="list-style-type: none"> d. Symmetric normal contact solution e. Consistent normal contact f. Face to face contact g. Interface element <ul style="list-style-type: none"> 4. Frictional contact <ul style="list-style-type: none"> a. Kinematics of frictional contact on curved surfaces b. Frictional contact constraint c. Stick-slip criteria d. Non-associated slip rules e. Basic contact stress update formulation f. Consistent slip operator g. Tear and wear criteria h. Forming and other engineering applications 5. Discontinuum contact <ul style="list-style-type: none"> a. Multibody contacts b. Object representation <ul style="list-style-type: none"> a. Disks b. Ellipsoids c. Multiquadrics c. Contact detection <ul style="list-style-type: none"> a. Global search by ADT b. Local search d. Contact interaction 6. Contact related localization and fracture
Computer usage:	Necessary for assignments and final project
Assignments:	10 homework assignments (programming and theoretical)
Projects:	1 final programming project
Grading:	Assignments: 20 % Project: 40 % Final exam: 40 %
Further readings:	[1] Several papers published on the subject every year.
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