



SVEUČILIŠTE U SPLITU
FAKULTET GRAĐEVINARSTVA,
ARHITEKTURE I GEODEZIJE

UNIVERSITY OF SPLIT
FACULTY OF CIVIL ENGINEERING,
ARCHITECTURE AND GEODESY

FDEM Application in Engineering 2018



University of Split

Spend your summer at
SPLIT SUMMER SCHOOL for students
of Civil Engineering, Architecture & Geodesy
CROATIA / Split

Welcome to Split Summer School!

The Course: FDEM Application in Engineering

Application of Finite Discrete Element Method (FDEM) in engineering provides start-up for the practical use of Y-2D numerical program based on FDEM method in engineering. The motivation for conducting this course arises from the fact that knowledge of basics of FDEM is an essential skill for numerical modelling of discontinuum problems. The course will provide participants with skills to learn about FDEM application in reinforced concrete and masonry structures and about the limitations and further development of FDEM by parallelization approach.

We would like to introduce you to the people organising the course and to the lecturers.

Organising committee

Boris Trogrlić Ph.D. Dean, Associate professor btrogrlic@gradst.hr	Mirela Galić Ph.D. Vice Dean for Int. Cooperation, Associate professor mgalic@gradst.hr	Ana Jeličić Mag. ing. aedif. Academic Associate ana.jelicic@gradst.hr
		

Lecturers

Ante Munjiza Ph.D. Professor btrogrlic@gradst.hr	Hrvoje Smoljanović Ph.D. Assistant professor hsmoljanovic@gradst.hr	Nikolina Živaljić Ph.D. Assistant professor nzivaljic@gradst.hr	Milko Batinić M. Civ. Eng. Research assistant mbatinic@gradst.hr
			



Program structure

Sunday, 2/9 Faculty Entry hall

19.00-20.30	Registration
20.30 - ...	Welcome and address by Organising Committee

Monday, 3/9 Classroom B2, 4th floor

9.00 – 9.30	Introduction (to the course, the participants and the lecturers)
09.30 - 10.30	Lecture: Continuum and discontinuum hybrid multiphysics simulation
10.30 - 11.00	Coffee break: cafeteria, -1 st floor
11.00 - 12.30	Lecture: Continuum and discontinuum hybrid multiphysics simulation
12.30 - 13.30	Lunch break: student restaurant, -1 st floor
13.30 - 14.15	Exercise: Modelling and analysis of benchmark examples

Tuesday, 4/9 Classroom B2, 4th floor

09.00 – 10.30	Lecture: Continuum and discontinuum hybrid multiphysics simulation
10.30 - 11.00	Coffee break: cafeteria, -1 st floor
11.00 - 12.30	Lecture: Continuum and discontinuum hybrid multiphysics simulation
12.30 - 13.30	Lunch break: student restaurant, -1 st floor
13.30 - 14.15	Exercise: Modelling and analysis of benchmark examples

Wednesday, 5/9 Classroom B2, 4th floor

09.00 - 09.45	Lecture: FDEM application in masonry structures
09.45 - 10.30	Lecture: FDEM application in reinforced concrete structures
10.30 - 11.00	Coffee break: cafeteria, -1 st floor
11.00 - 12.30	Exercise: Modelling and analysis of benchmark examples
12.30 - 13.30	Lunch break: student restaurant, -1 st floor
	Free time



Thursday, 6/9 Classroom B2, 4th floor

09.00 – 10:30	Exercise: Modelling and analysis of simple masonry structures
10.30 - 11.00	Coffee break: cafeteria, -1 st floor
11.00 – 12.30	Exercise: Modelling and analysis of simple RC structures
12.30 - 13.30	Lunch break: student restaurant, -1st floor
13.30 – 15.00	Parallelization concepts in FDEM– CUDA, OpenCL, MPI
	Free time on beach

Friday, 7/9 Classroom B2, 4th floor

09.00 – 10.30	Final project: individual work with assistance (completion of the projects and preparation of the presentations)
10.30 - 11.00	Coffee break: cafeteria, -1 st floor
11.00 – 12.30	Final project: individual work with assistance (completion of the projects and preparation of the presentations)
12.30 - 13.30	Lunch break
13.30 - 15.30	Final projects presentations
	Free time
18.30-19.30	Diploma awarding
19:30 -	Dinner at Faculty restaurant



Learning materials

E-learning

<http://cigla.gradst.hr/moodle26/>

books

Munjiza A. *The combined finite-discrete element method*, UK: John Wiley & Sons; 2004.

Munjiza A, Knight EE, Rouiger E. *Computational Mechanics of Discontinua*, UK: John Wiley & Sons; 2012.

Munjiza A, Knight EE, Rougier E. *Large Strain Finite Element Method: A Practical Course*. UK: John Wiley & Sons; 2015.

Articles

Munjiza A, Owen DRJ, Bicanic N. A combined finite-discrete element method in transient dynamics of fracturing solids. *Engineering Computations* 1995; 12: 145-174.

Munjiza A, John NWM. Mesh size sensitivity of the combined FEM/DEM fracture and fragmentation algorithms. *Engineering Fracture Mechanics* 2001; 69 (2): 281-295.

Munjiza A, Bangash T, John NWM. The combined finite-discrete element method for structural failure and collapse. *Engineering Fracture Mechanics* 2004; 71 (4-6): 469-483.

Munjiza A, Andrews KRF, White JK. NBS contact detection algorithm for bodies of similar size. *International Journal for Numerical Methods in Engineering* 1998; 43: 131-149.

Munjiza A, Rougier E, John NWM. MR linear contact detection algorithm. *International Journal for Numerical Methods in Engineering* 2006; 66 (1): 46-71.

Xiang J, Munjiza A, Latham JP, Guises R. On the validation of DEM and FEM/DEM models in 2D and 3D. *Engineering Computations* 2009; 26: 673-687.

Munjiza A, Owen DRJ, Crook AJL. An $M(M-1)K_m$ proportional damping in explicit integration of dynamic structural systems. *International Journal for Numerical Methods in Engineering* 1998; 41 (7): 1277-1296.

Munjiza A, Andrews KRF, White JK. Combined single and smeared crack model in combined finite-discrete element method. *International Journal for Numerical Methods in Engineering* 1999; 44: 41-57.

Smoljanović H, Živaljić N, Nikolić Ž. A combined finite-discrete element analysis of dry stone masonry structures. *Engineering Structures* 2013; 52; 89–100.



Smoljanović H, Nikolić Ž, Živaljić N. A combined finite-discrete numerical model for analysis of masonry structures. *Engineering Fracture Mechanics* 2015; 136: 1-14.

Živaljić N, Smoljanović H, Nikolić Ž. A combined finite-discrete element model for RC structures under dynamic loading. *Engineering Computations* 2013; 30 (7): 982-1010.

Živaljić N; Nikolić Ž; Smoljanović H. Computational aspects of the combined finite– discrete element method in modelling of plane reinforced concrete structures. *Engineering fracture mechanics* 2014; 131:669-686.

