

Course title: Boundary Element Method	Neptun code: GEMET406-a
Course coordinator: Dr. György Szeidl, DSc, professor emeritus	
type of lesson and number of lessons: lecture (2)	
method of evaluation: colloquium	
curriculum location of the subject: (autumn/spring semester): autumn and spring	
pre-study conditions (<i>if any</i>): GEMET401a Continuummechanics	
The task and purpose of the subject:	
<p>The boundary element method, like the finite element method, is a tool for the numerical solution of mechanical problems. Several serious commercial software systems exist. The main objective of the course is to introduce the students to the basics of the boundary element method. Within the framework of the course, special emphasis will be given to the technique of generating basic solutions, since the method is based on it. A further aim is to review the basic concepts and the principles that underlie the numerical solution of the relevant singular integral equations in such a way as to enable students to use commercially available boundary element programs.</p>	
Course description:	
<p>Classification of boundary value problems for the plane Poisson's equation. The fundamental solution and its properties. The Green identity with proof. The first, second and third Green formulas for inner regions. Regular functions in finite and at infinity. Integral equations of the indirect method. Gradient of the scalar field $u(Q)$ using the first Green formula. Single and double layer potentials – definitions and properties. Integral equations of the direct method. Boundary elements with linear and quadratic approximations of the geometry and the unknown quantities. Triangular elements on the inner domain. Numerical solution of the integral equation of the direct method – reduction of the solution to a system of linear equations. Problems of numerical integration. Methods of calculating weakly and strongly singular integrals. Corner points and discontinuous elements. Equations of plane elasticity. Derivation of uncoupled equations – Galerkin functions and fundamental solutions of order one and two. Somigliana identity and the first, second and third Somigliana formulas for inner regions. Equations of the direct method. Somigliana formulas for outer regions. Solution techniques for solving the integral equations of the direct method. Examples.</p>	
Required literature:	
<ol style="list-style-type: none"> 1. György Szeidl: Introduction to the boundary element method. (Hand written notes given freely to the students.) 2. Brebbia, C.A., Symm, G.T.: Boundary Elements (an Introductory Course), McGraw Hill, 1991. 	
Recommended literature:	
<ol style="list-style-type: none"> 1. Jaswon, M. A., Symm, G. T.: Integral Equation Methods in Potential Theory and Elastostatics, Academic Press, London, 1977. 	