

Course title: Nonlinear Vibrations	Neptun code: GEMET411-a
Course coordinator: Szirbik Sándor Mátyás, PhD, associate professor	
type and number of lesson: Weekly lecture + seminar hours: 2+0	
method of accountability: colloquium	
curriculum location of the subject: autumn/spring	
pre-study conditions:	
The task and purpose of the subject:	
The course provides information on the techniques and methods for investigating the nonlinear behavior of dynamic systems.	
Course description:	
Nonlinearities in mechanical systems. Phase portraits of the autonomous single-degree-of-freedom systems. Lyapunov stability. Lyapunov functions. Chetaev's theorem. Structural stability. Parameter-excited vibrations. Familiar nonlinear equations: Duffing equation, van der Pol's equation, Hill's equation, and Mathieu's equation. Forced Duffing oscillators. Ritz-Galerkin method. Bubnov-Galerkin method. Perturbations. Lindstedt-Poincaré method. Application of the two time-scales perturbation method. Plot of frequency response of forced Duffing oscillators. Stability behavior. Floquet theory. Mathieu instability diagrams.	
Required literature:	
<ol style="list-style-type: none"> 1. Meirovitch, L.: Methods of Analytical Dynamics, McGraw-Hill, 1988. 2. Rand, R. H.: Lecture notes on nonlinear vibrations, Department of Theoretical and Applied Mechanics, Cornell University, 2012. https://ecommons.cornell.edu/handle/1813/28989 	
Recommended literature:	
<ol style="list-style-type: none"> 1. Dresig, H.; Holzweißig, F.: Dynamics of Machinery: Theory and Applications, Springer-Verlag Berlin Heidelberg 2010. 2. Cveticanin, L.: Strongly Nonlinear Oscillators Analytical Solutions, Springer, 2018. 	