Sisteme giroscopice complexe de orientare, stabilizare si control	Complex gyroscopic systems for orientation, stabilization and control
Obiectiv principal	**Course Objective**
Contribuie la perfectionarea inginerilor de profil aerospatial, familiarizându-i cu modelarea matematica a girostabilizatoarelor de forta monoaxiale, biaxiale si triaxiale, a capetelor giroscopice de dirijare, precum si sinteza in frecventa a diferitelor structuri de girosisteme pentru orientare si stabilizare.	It contributes to the improvement of the aerospace engineers, familiarizing them with the mathematical modeling of the monoaxial, biaxial and triaxial force gyrostabilizers, the guiding gyroscopic heads, as well as the frequency synthesis of the various gyro system structures for orientation and stabilization.
Curs	**Course**
2 ore/săptămână, total 28 ore	2 hours weekly, 28 hours total
• Modelarea matematica a girostabilizatoarelor de forta monoaxiale, biaxiale si triaxiale cu diferite tipuri de giroscoape mono si birotor, cu retele de corectie de tip integrator, integro-diferentiator si rotitor de faza. Forme diferentiale si matriceale, liniare si neliniare. Analiza stabilitatii • Capete giroscopice de dirijare. Descrierea matematica a miscarii diferitelor variante de capete de dirijare: cu giroscop in suspensie cardanica interioara, respectiv exterioara; cu doua giroscoape cu axele de precesie ortogonale respectiv coliniare si cu giroscoape diferentiatoare; cu trei giroscoape. Forme diferentiale si matriceale, liniare si neliniare. Studiul stabilitatii • Dinamica sistemelor giroscopice liniare: modele neliniare ale cuplajelor disipative, elastice, elastic-disipative si cu luft; descrierea operatoriala a miscarii; studiul girosistemelor neliniare cu parte liniara nefiltranta, liniarizarea armonica; studiul regimurilor autooscilante ale girosistemelor cu cuplaje neliniare interioare si exterioare disipative, analiza stabilitatii, calculul parametrilor regimurilor periodice; regimuri autooscilante de tip releu-alunecatoare, stabilitatea girosistemelor cu frecare uscata; regimuri autooscilante ale girosistemelor cu luft si cuplaje elastic-disipative neliniare, analiza stabilitatii, calculul parametrilor autooscilatiilor; influenta cuplajelor ortogonale; metode de amortizare a regimurilor periodice • Sinteza sistemelor giroscopice pentru stabilizare, navigatie si dirijare: sinteza in frecventa a diferitelor structuri de girosisteme pentru orientare si stabilizare, monoaxiale, biaxiale si triaxiale; sinteza optimala a girostabilizatoarelor de forta si a capetelor giroscopice de dirijare dupa criteriul timpului minim in conditii de informatii complete, respectiv incomplete; sinteza girosistemelor dupa criteriul patratic de calitate; sinteza statistica a girostabilizatoarelor de forta; sinteza optimala a sistemelor giroscopice in conditii de perturbatii aleatoare; utilizarea filtrului Kalman-Bucy ca estimator de	• Mathematical modeling of monoaxial, biaxial and triaxial force gyro-stabilizers with different types of mono and office gyroscopes, integrator-correction networks, integral-differentiator and phase-rotor. Differential and matrix forms, linear and nonlinear. Stability analysis • Gyroscopic guidance heads. The mathematical description of the movement of the various variants of the guiding heads: with a gyroscope in the inner and outer cardan suspension; with two gyroscopes with orthogonal or collinear precession axes and with differential gyroscopes; with three gyroscopes. Differential and matrix forms, linear and nonlinear. Stability study • Dynamics of linear gyroscopic systems: nonlinear models of dissipative, elastic, elastic-dissipative and luft couplings; the operative description of the movement; the study of non-linear nonlinear gyro-systems with linear non-linear part, harmonic linearization; girosistemelor auto oscillating regimes study of the inner and outer couplings dissipative non-linear, stability analysis, calculating the periodic arrangements parameters; auto-shrinking relay-slip modes, stability of dry friction gyrosystems; girosistemelor auto oscillating modes of the rebate and the elastic coupling-dissipative nonlinear stability analysis, calculation of the parameters autooscilatiilor; the influence of orthogonal couplings; methods of damping periodic regimes • Synthesis of gyroscopic systems for stabilization, navigation and routing: frequency synthesis of different gyro system structures for orientation and stabilization, monoaxial, biaxial and triaxial; girostabilizatoarelor optimal synthesis of force and gyroscopic steering heads criterion minimum time under complete information or incomplete; synthesis of gyrosystems according to the patrician quality criterion; statistical synthesis of force gyrostabilizers; optimal synthesis of gyroscopic systems in random disturbance conditions; using the Kalman-Bucy filter as a state estimator • Design of structural elements, components of gyroscopic systems: gyromotors; cardanic, floating, gas-dynamic, magnetic and electrostatic suspensions; torque-type construction equipment, stabilizer motor with and without mechanical reducer etc .; information acquisition devices, measurement and distance

stare • Proiectarea elementelor structurale, componente ale sistemelor giroscopice: giromotoarelor; suspensiilor cardanice, cu flotor, gazodinamice, magnetice si electrostatice; echipamentelor de executie de tip motor de cuplu, motor de stabilizare cu si fara reductor mecanic etc.; dispozitivelor de achizitii a informatiilor, sistemelor de masurare si transmitere la distanta a semnalelor proportionale cu marimile unghiulare; dispozitivelor de amortizare si blocare; sistemelor de reglare automata a temperaturii in incintele giroscopice	transmitting systems of proportional signals with angular dimensions; damping and locking devices; automatic temperature control systems in gyroscopic enclosures
Laborator	**Laboratory**
1 ora/săptămână, total 14 ore	1 hour weekly, 14 hours total
• Testarea giroplatformelor de tip SFIM • Testarea capetelor giroscopice de dirijare cu giroscoape in suspensie cardanica interioara • Studiul unei platforme giroscopice de tip Strap-Down • Proiectarea girostabilizatoarelor de forta monoaxiale asistata de calculator, folosind metode frecventiale • Proiectarea girosistemelor monoaxiale pentru orientare si stabilizare folosind algoritmi bazati pe criterii patratice de calitate • Girostabilizatoare de forta cu estimatoare de stare deterministe • Filtrarea erorilor de stabilizare ale girosistemelor folosind filtrul Kalman-Bucy	• Testing SFIM type gyroplasts • Testing gyroscopic guiding heads with gyroscopes in internal cardanic suspension • Study of a Strap-Down gyroscopic platform • Design of monoaxial gyro-stabilizers assisted by computer, using frequency methods • Design of monoaxial gyrosystems for orientation and stabilization using algorithms based on qualitative quadratic criteria • Girostabilizers of force with deterministic state estimators • Filter for stabilization errors of gyro systems using the Kalman-Bucy filter