2-5520 Theory of Mechanisms

for bachelors study in 3rd year-classis, summer semester

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Syllabus of course

1. Goals in the analysis and synthesis of multibody systems. Properties of structural parameters of multibody systems, local and global position coordinates of links, local mobility of body in geometrical constraint. Mobility of correct multibody system, actual mobility of incorrect multibody system with slipping and rolling geometrical c onstraint.

2. Instantaneous slew centre (OSO) of a body. Replacement of general motion of a body by rolling of movable centrode against fixed centrode. Application of principle of mutually rolling centrodes in mechanisms.
3. Unit vectors of local position frame of body, when its origin moves along prescribed curve. Instantaneous velocity, tangential and normal accelerations of body point. Euler's equation for velocity of the point of rotating body. Kinematic quantities for translational and rotational motion of a body.
4. Poissont's decomposition of general planar motion of the body to the fictive translation represented by reference point and to the fictive rotation about reference point. Development of general formula for time derivation of the vector expressed in different spaces.
5. Decomposition of the body general planar motion to the simultaneous fictive carying motion and fictive local relative motion. Resulting angular velocity of the body in the multibody system during simultaneous motions. Resal's angular acceleration and resulting angular acceleration of the body in the multibody system during simultaneous motions.
6. Resulting velocity of the body in the multibody system during simultaneous motions. Coriolis'es acceleration and resulting acceleration of the body in the multibody system during simultaneous motions.
7. Graphical methods of Poissont's decomposition of general planar motion of the body and decomposition of the body general planar motion to the simultaneous fictive carying motion and fictive local relative motion application in the mechanisms.
8. Development of vectorial and scalar loop constraint equations for position kinematic analysis of planar mechanism. Jacobi matrix of constraint equations. Newton-Raphson numeric method for computing of unknown dependent global position coordinates of output links in mechanism.
9. Turning and centering acceleration of the point during spherical motion of the body. Euler's angles for precession, nutation and local rotation. Euler's kinematics equations, applications of the spherical motion in mechanisms.
10. Poissont's decomposition of general spatial motion of a body to the fictive translation of a body represented by reference point and to the fictive spherical motion of a body about reference point. Description of general spatial motion of a body by instantaneous

tangential screw motion of a body wrt axis of viration. Applications of general spatial motion of a body in mechanisms.

11. Kinematic position analysis of spatial, open, closed and mixed mechanisms via transformation matrices. The fictive cut across frame and arbitrary link in the basic loop of links.
12. Synthesis of planar mechanisms. Task categories of mechanisms. Mobility of mechanisms from statics, kinematics a dynamics point of view. Continuity of statics, kinematics a dynamics according to the theory of line vectors couples. Showtimes of computer aided analysis and synthesis of mechanisms.