**Notes Topics**

01\_01 Definitions, skeletal diagrams, mobility, topology, connectivity, tracked excavator, Wanzer needle bar, Grashof criterion (new dwg), dyad driver

01\_02 3D joints, skeletal diagrams, McPherson strut, Stewart-Gough platform, 3D four bar

02\_01 Working Model (WM) tutorial for slider crank

02\_02 Working Model for four bar D mechanism

02\_03 Adams tutorial for four bar and slider crank

02\_04 SolidWorks (SW) Motion tutorial

03\_01 Geometric kinematics for four bar and slider crank

03\_02 Complex numbers for planar kinematics, four bar, in-line and offset slider crank, and inverted slider crank, MATLAB code

03\_03 Newton-Raphson algorithm, Newton-Raphson for four bar, numerical partial derivatives, MATLAB code

03\_04 Polycentric hinge, sewing machine

03\_05 Instantaneous centers, velocity transfer, sewing machine, rigid body, Norton mechanisms, centrodes of four bar, instantaneous screw axes, knee ACL and PCL

03\_06 Instantaneous screw axis, finite screw axis, axode

04\_01 Two-dimensional vector and matrix notation

04\_02 Two-dimensional coordinate transformations

04\_03 Two-dimensional kinematics

04\_04 Two-dimensional constraints

04\_05 Two-dimensional position, velocity and acceleration solutions, four bar example, examples for other mechanisms

04\_06 D mechanism, MATLAB code

04\_07 Two-dimensional autofill constraint vector and Jacobian

# 05\_01 Numerical derivatives using Savitsky-Golay floating cubic interpolants, MATLAB code

05\_02 Two-dimensional experimental kinematics, rigid body, MATLAB code

05\_03 Three-dimensional experimental kinematics, MATLAB code

06\_01 Static force analysis - four bar scalar, four bar superposition, four bar matrix, pushups matrix, slider crank scalar, slider crank matrix

06\_02 Virtual work

06\_03 Static force analysis – virtual work (skid loader, sewing machine, four bar, pushups)

07\_01 Mass moment of inertia quiz, review, disk with slots

07\_02 Polygonal approximation of boundary integrals for area, centroid and area moment of inertia, object with holes, MATLAB code

07\_03 Measuring mass moment of inertia with simple pendulum, torsional pendulum, centroid location and multiple pivots, MATLAB code

07\_04 Vehicle inertial measurements

08\_01 Forward versus inverse dynamics, inverse dynamics, printer hammer, matrix

08\_02 Matrix dynamic analysis for four bar and slider crank (same four bar as kinematics)

08\_03 d’Alembert’s Principle, printer hammer, four bar

08\_04 Two-mass equivalent link, shaking force for slider crank, in-line two cylinder air compressor, in-line four cylinder engine, in-line six cylinder engine, shaking force for four bar

08\_05 Multiplanar balancing (flywheel, measure imbalance)

08\_06 Coulomb friction in prismatic joint, Coulomb friction in revolute joint, free vibration with viscous damping, free vibration with Coulomb friction, Pacejka magic formula

08\_10 Two-dimensional generalized forces

08\_11 Two-dimensional inverse dynamics

08\_12 Two-dimensional forward dynamics

08\_13 DAE for anthropomorphic manipulator

08\_15 Automatic generation of EOM

08\_21 Third order dynamics

09\_01 Forward dynamics

09\_02 Lagrangian dynamics for simple pendulum, spring-mass, cylindrical coordinate manipulator, two link anthropomorphic manipulator (double pendulum), three link anthropomorphic manipulator, linear state space model for two link manipulator

10\_01 State space model for spring-mass-damper and double spring-mass-damper, numerically evaluate linear state matrix

10\_02 Forward time integration, MATLAB code

10\_03 Friction reversal and collision, coordinate partitioning, constraint stabilization, Gaussian elimination

10\_04 Collision detection for polygonal objects, bounding circle, axis aligned bounding box, point in polygon, edge intersection, separating axis theorem, classification of contacts, interpolating time of collision, three-dimensional collision detection, handling collision

10\_05 Joint compliance, flexible elements

11\_01 Three-dimensional vector and matrix notation

11\_02 Chasles angle, Euler parameters, coordinate transformations

11\_03 Three-dimensional kinematics (change  for snap)

11\_04 Three-dimensional constraints (local joint definition frames, new figures)

11\_05 Three-dimensional position, velocity and acceleration solutions

11\_06 Three-dimensional mass moment of inertia

11\_07 Three-dimensional generalized forces

11\_08 Three-dimensional dynamics

11\_11 RSUR geometric method, spherical four bar geometric method

11\_12 RSUR generalized coordinates

11\_13 RSUR D-H notation

11\_14 RSSR generalized coordinates

11\_15 RSPU geometric method

11\_16 RSPU generalized coordinates

11\_17 RSSP geometric method

11\_18 RSSP generalized coordinates

11\_19 RCCC generalized coordinates

x\_01 Lagrange multiplier

x\_02 old polygeom