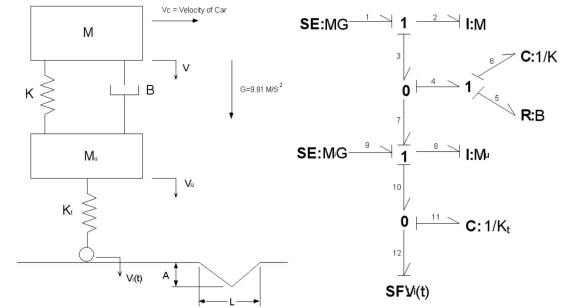
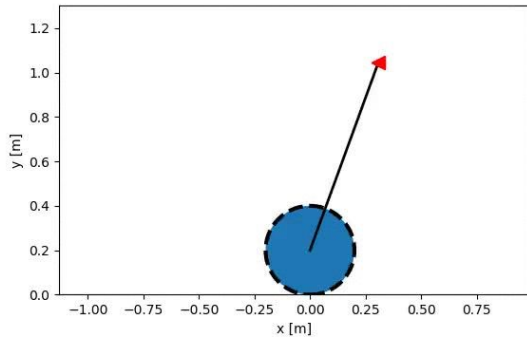


EME 171

Analysis, Simulation, and Design of Mechatronic Systems

Winter 2020

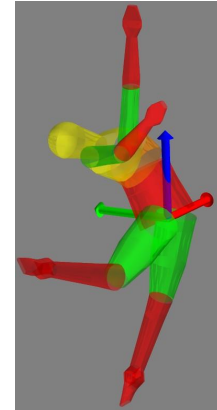
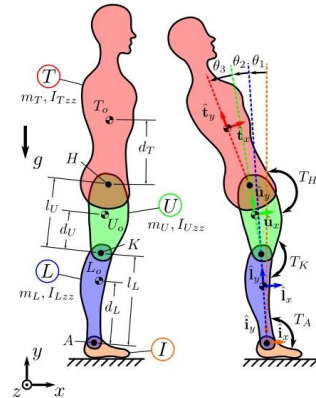


Primary Instructor: Jason K. Moore

BS @ ODU 2004, Fulbright TU Delft 2009, MS/PhD @ UCD 2007/2012

Assistant Professor of Teaching since 2015 @ UC Davis

Teaches: dynamics, vibrations, biomechanics, mech. design, computer graphics, and capstone



Projects

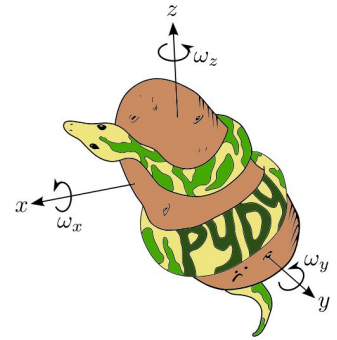
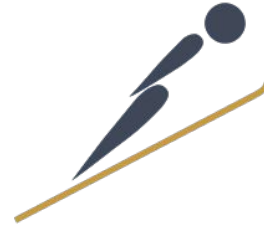


Laboratorium of Marvelous Mechanical Motum

<https://mechmotum.github.io/>



Google
Summer of Code



Teaching Assistant: Sergio Guillen

- PhD student working with Prof. Assadian
- BS from Sacramento State University
- Research: integrated automotive control

What will you be able to do after this
class?

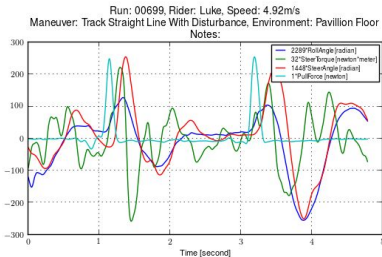
Modeling and Simulation of Dynamic Systems



Real World



Measurements



Measurements of real world

Abstraction

Domain Specific Schematics

Domain Neutral Schematic: Bond Graph

Mathematical Model

$$\frac{d}{dt} \begin{bmatrix} p_2 \\ q_5 \end{bmatrix} = \begin{bmatrix} -R_3/I_2 & -1/C_5 \\ 1/I_2 & -1/R_6C_5 \end{bmatrix} \begin{bmatrix} p_2 \\ q_5 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} e_1(t).$$

Computational Model

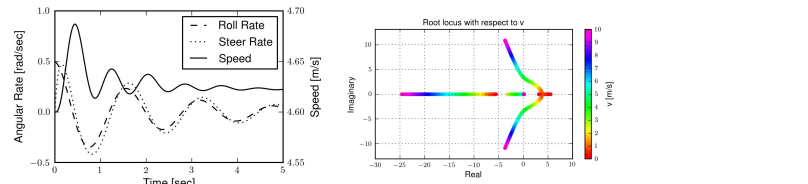
```

% forces acting on a bicyclist
Fd = 1/2*rho*Cd*A*v^2; % drag force [N]
Fr = Cr*m*g*cos(alpha); % rolling resistant [N]
Fg = m*g*sin(alpha); % gravity force [N]

% evaluate the four 1st order explicit ordinary differential equations
thetadot = omega;
omegadot = (tau^1 - br*omega - Fd/R - Fr/R - Fg/R) / (J^2 + m*R^2);
idot = (b0^1 - k^1*omega - v)/L;
xdot = v*cos(alpha);

% pack the state derivatives in a vector
sdot = [thetadot; omegadot; idot; xdot];
                    
```

Analysis & Simulation



Prediction of real world

Validation



Example: Electric Bicycle/Motorcycle

