

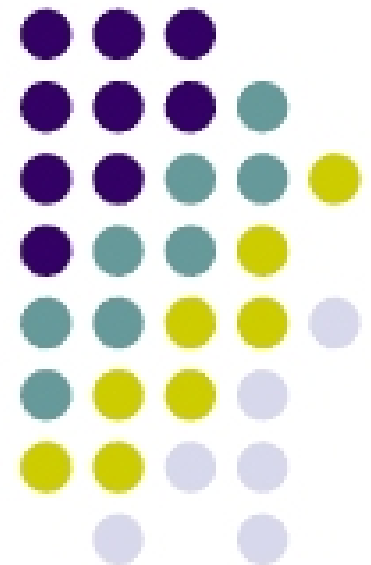
ME451

Kinematics and Dynamics of Machine Systems

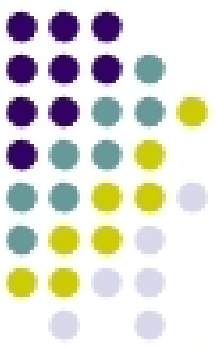
Dynamics of Planar Systems

November 17, 2011

Finish 6.3

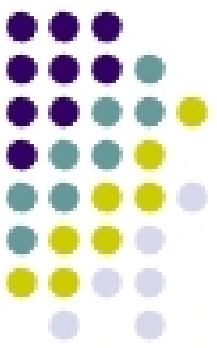


Before we get started...



- Last Time
 - Looked at the contribution to the EOM of an external force or torque that is applied at a point P (how to get a generalized force Q^A)
 - Discussions of TSDA & RSDA
 - Started discussion about how to get the EOM for a set of bodies (a mechanism)
- Today:
 - Wrap up EOM discussion after we introduce the Lagrange Multiplier Theorem
 - Example: EOM for a slider-crank mechanism
 - Discuss why and how to specify Initial Conditions (ICs)
 - Example: Pendulum, setting a set of ICs
- HW due Tuesday, Nov 29:
 - 6.1.1 thru 6.1.4, and 6.2.1
 - MATLAB component will be emailed to you

Getting Rid of the Internal Forces: Summary



- **Our Goal**: Get rid of the constraint forces \mathbf{Q}^C since we don't know them
- For this, we had to compromise...
 - We gave up our requirement that $\delta \mathbf{q}^T [\mathbf{M}\ddot{\mathbf{q}} - \mathbf{Q}] = 0$ holds for **any arbitrary virtual displacement**
 - Instead, by only selecting **virtual displacements $\delta \mathbf{q}$ that are consistent with the set of constraints** present in the system, we saw that we can get rid of \mathbf{Q}^C :

$$\delta \mathbf{q}^T [\mathbf{M}\ddot{\mathbf{q}} - \mathbf{Q}^A] = 0$$

...whenever...

$$\Phi_{\mathbf{q}} \delta \mathbf{q} = 0$$

NOMENCLATURE: Constrained Variational Equations of Motion

This is the condition that it takes for a virtual displacement $\delta \mathbf{q}$ to be consistent with the set of constraints