Physically-based animation
II – Rigid Body dynamics

Stephane Redon
NANO-D – INRIA

November 22, 2010 – M2R-MOSIG
Rigid body dynamics

• Unconstrained rigid body dynamics
Rigid body dynamics

• Unconstrained rigid body dynamics
• Collisions and persistent contacts
Rigid body dynamics

• Unconstrained rigid body dynamics
• Collisions and persistent contacts
• From one rigid body and one contact point…
Rigid body dynamics

- Unconstrained rigid body dynamics
- Collisions and persistent contacts
- From one rigid body and one contact point…
- …to N rigid bodies and M contact points
Rigid body dynamics

- Unconstrained rigid body dynamics
- Collisions and persistent contacts
- From one rigid body and one contact point…
- …to N rigid bodies and M contact points
- Gauss’ least constraint principle
Rigid body dynamics

• Unconstrained rigid body dynamics
• Collisions and persistent contacts
• From one rigid body and one contact point…
• …to N rigid bodies and M contact points
• Gauss’ least constraint principle
• Putting it all together
External Forces

dynamics calculator

Constrained acceleration computation

Intentional position and velocity computation at time $t+h$

Collision between $t$ and $t+h$?

no

Position and velocity computation at time $t+h$

$t \leftarrow t+h$

dynamics calculator

Post-impact velocities computation

$t \leftarrow t_c$

yes

Position and velocity computation at time $t_c$
Putting it all together