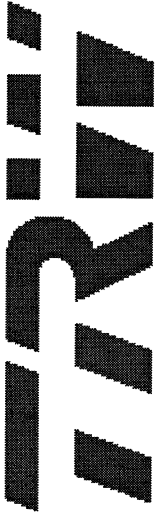
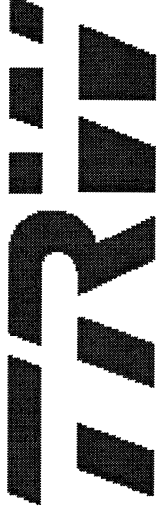


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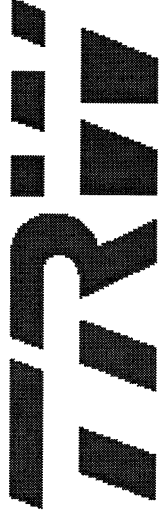
Analysis of Child Seat Cinch Mechanism

Sam McDonald, MDI
Rohit Tangri, TRW ORSG



ADAMS Simulation of Seat Belt Mechanisms

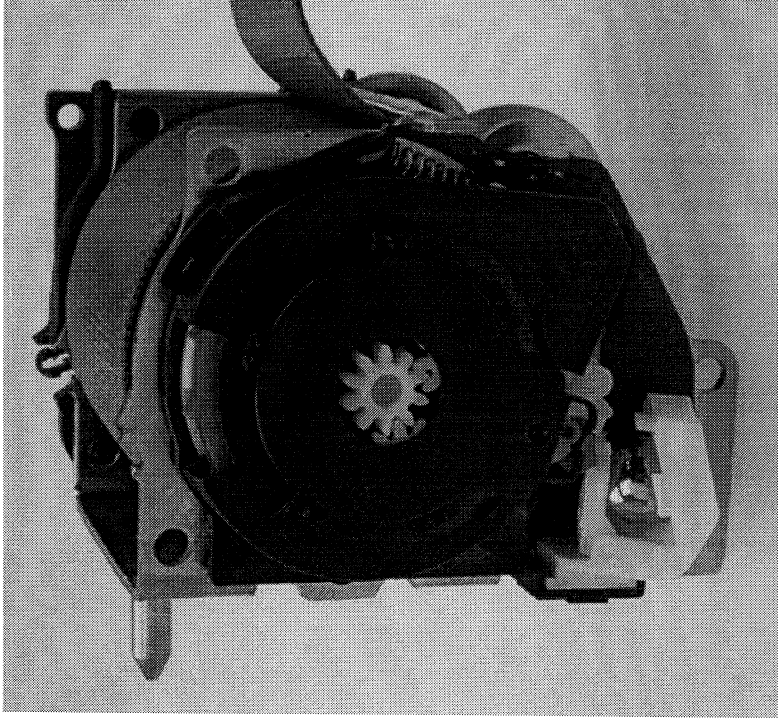
- ADAMS is used for mechanism design/performance at TRW (ORSG)
- Both in design and production phase
- Typical mechanisms include retractors, cinch, latch and buckle
- An ADAMS model of a child seat cinch mechanism is discussed

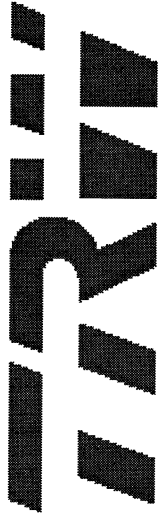


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Child Seat Locking Mechanism

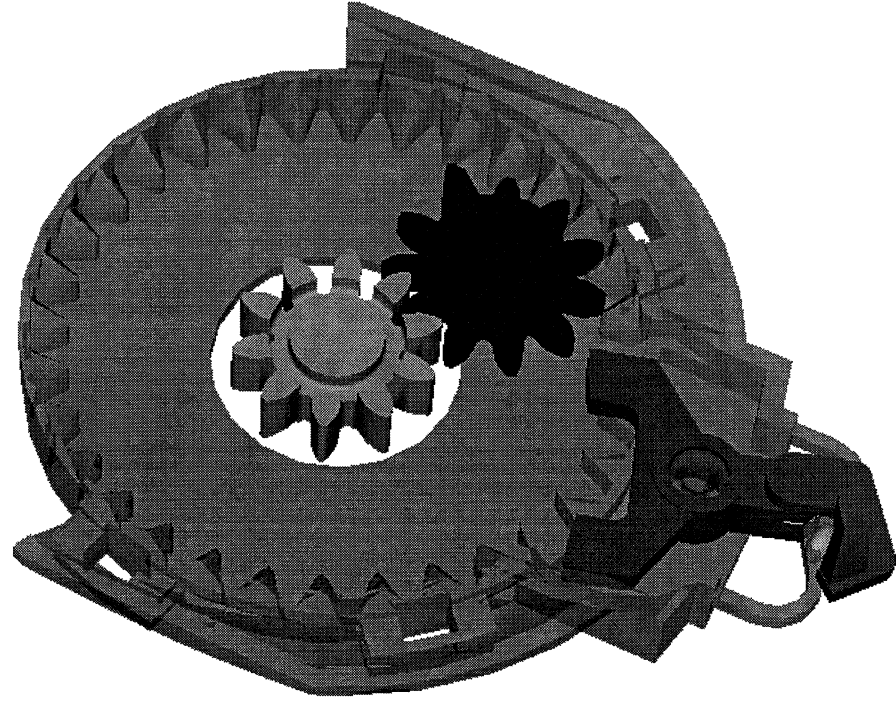
- Planetary Gear Cinch
- Ease of use
- Replaces “clips” when cinch device is present in vehicle seating position



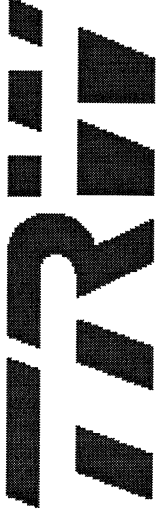


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Mechanism Description

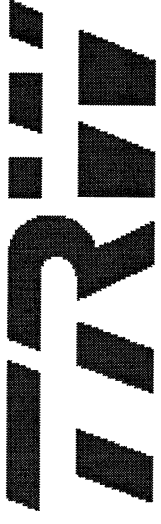


- Planetary gear design with sun, planetary, ring gears, rocker arm and plastic spring
- Cinch zones/timing controlled by “larger” teeth on planetary and contact with toggle arm



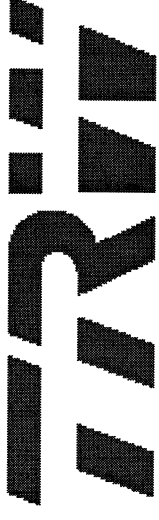
Objective Description

- Does cinch toggle as expected in a retractor assembly under varying conditions ?
- Use ADAMS model to correlate and examine factors to improve design



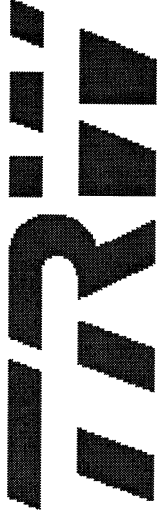
ADAMS Model

- Gear set and assembly has compliances
- Kinematic gears not adequate for this application
- Tooth to Tooth contact algorithm required to model
 - planets to sun gear contact
 - planets to ring contact



Special Contact Subroutines

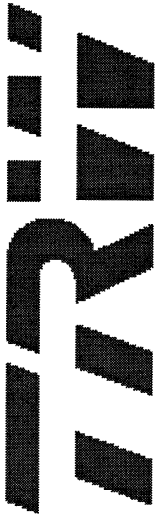
- **Special GFORCE subroutines developed**
 - Line segment based (2 GFORCE per gear pair, point to line segment)
 - static and dynamic friction
 - allows for small 3D effects
 - Full 3D effect with 2 pairs of GFORCE per gear set



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Special Contact Subroutines

- Other Contacts
 - sun gear joint slop
 - planetary gear wobble (3D) slop
 - spring (plunger) to rocker arm contact



Design Variables

- Factors influencing design/performance
 - Tolerances (sun-gear seating, toggle-arm pivot symmetry,
 - Slop (planetary/ring gear wobble, sun-gear joint slop)
 - Other
 - Friction
 - Toggle arm/planetary interface

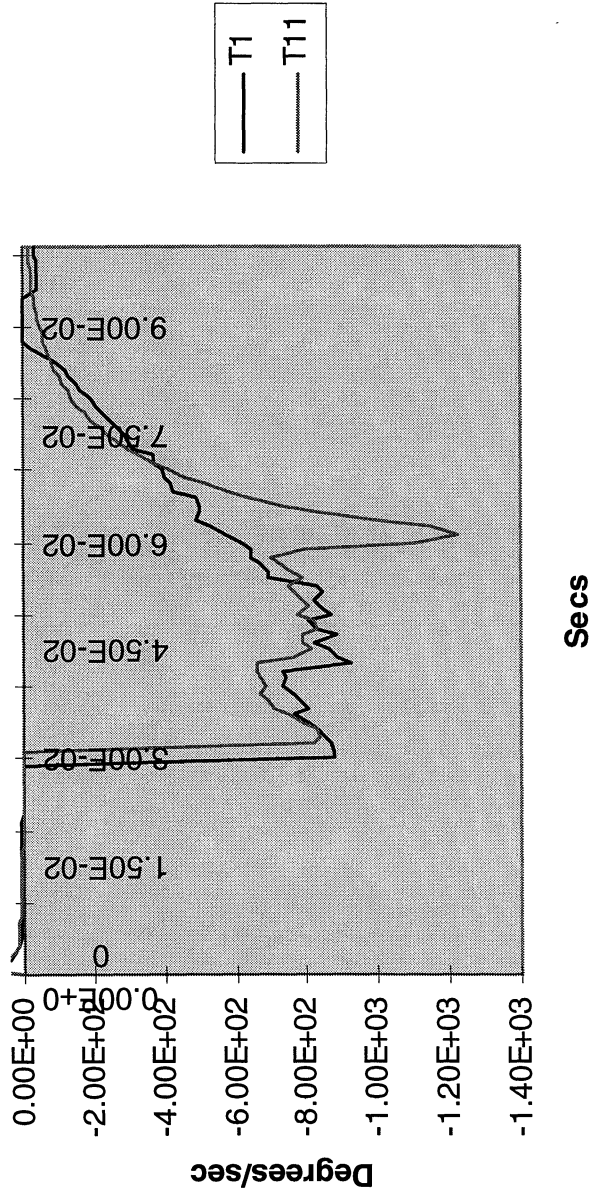


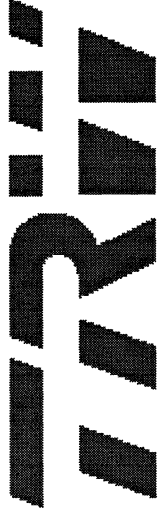
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Results

- Angular velocity peak (second) indicates crisp toggle

Rocker Angular Velocity

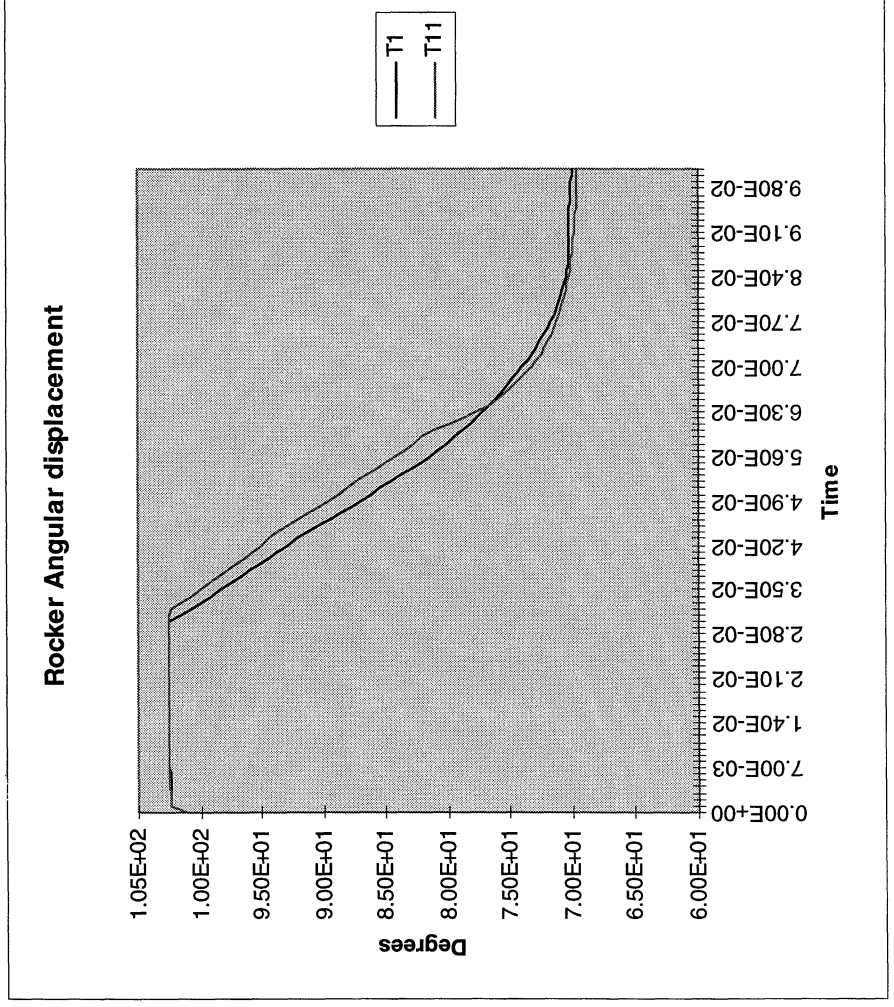


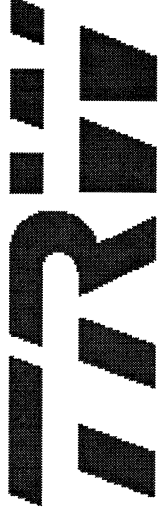


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Results

- Angular displacement difference is very small





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Future Work

- DOE still ongoing
- Need to decrease simulation time
- Need to develop generic GEAR contact pre-processor