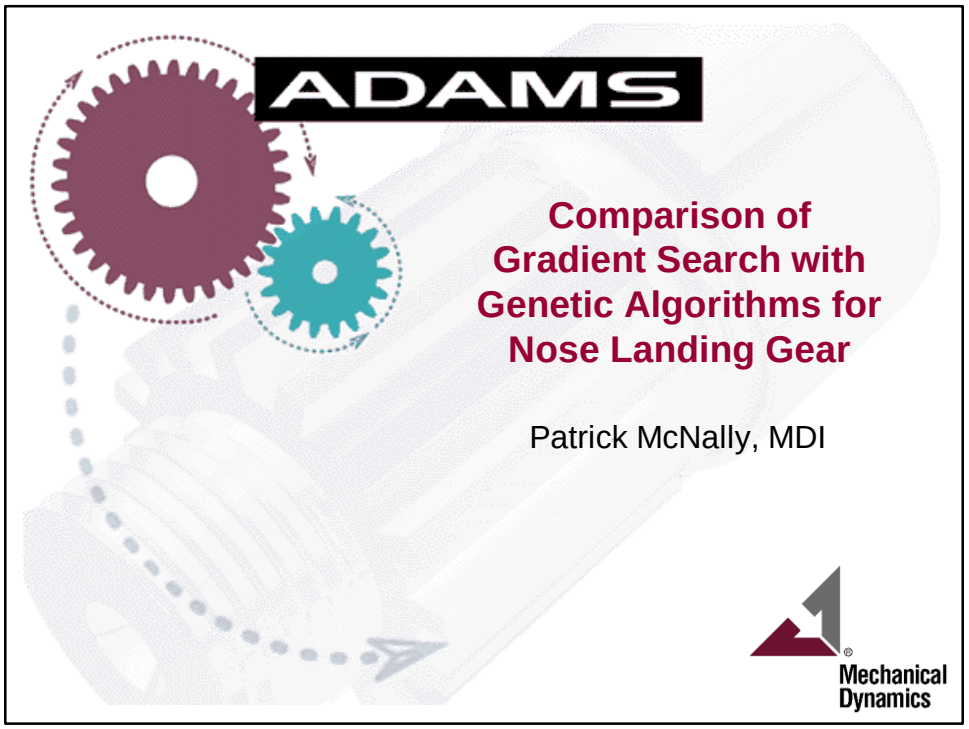
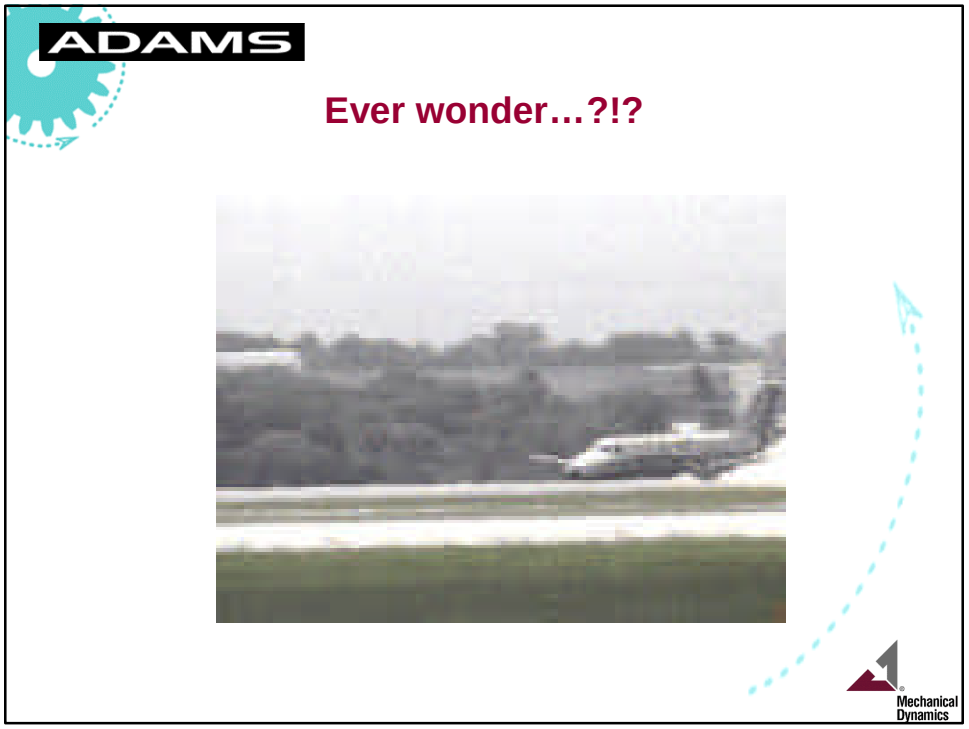
Comparison of Gradient Search with Genetic Algorithms for Nose Landing Gear





Comparison of Gradient Search with Genetic Algorithms for Nose Landing Gear

ADAMS

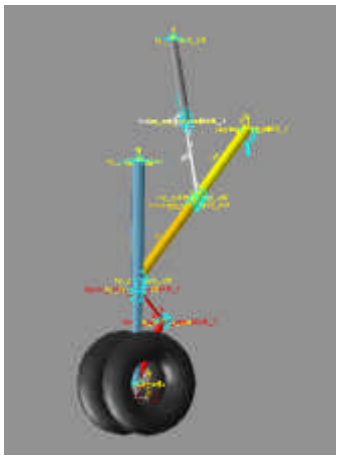
Which is Best for Landing Gear Optimization : Genetic Algorithms or Gradient Search?

- Optimize geometric layout
- Maximize retraction efficiency
  - used in actuator sizing
  - ensures constant demand on hydraulic system during actuation
- Optimization constraints to ensure full retraction and avoid lockup conditions

Mechanical Dynamics

ADAMS

Nose Landing Gear for Optimization



- Conventional aft-deploying (forward retracting) nose gear with collapsing brace
- Rigid Model only
- Design Variables:
  - 20 geometric layout variables
  - P1(x,y) -> P10(x,y)

Mechanical Dynamics

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Retraction Efficiency Function

$$\left|\max(F_R)\cdot z_{\max}\right| - \int_{z_0}^{z_{\max}} F_R(z)\cdot dz$$

Where

F_R ~ retraction force

z ~ retraction position

Rewritten as time function:

$$\left|\max(F_R)\cdot z_{\max}\right| - \int_{t_0}^{t_{\max}} F_R(z)\cdot \dot{z}\cdot dt$$

Solver and View language:

- View fun = (MAX{(Last_Run.MOT1.FZ.values)} * (MAX{Last_Run.DZ.values}) - LAST(.nosegear.DIFF_1))
- DIFF_1=MOTION(.nosegear.MOT1, 0, 1, 0) *VZ(.nosegear.lower_retraction.MAR507, .nosegear.upper_retraction.MAR407)

Mechanical Dynamics

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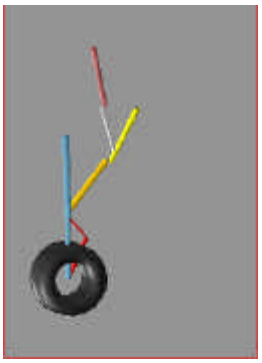
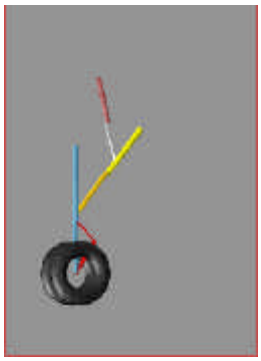
Initial Results Show Different Optimums Found through Different Searches



Gradient Search Optimization



Genetic Algorithm Optimization

Mechanical Dynamics

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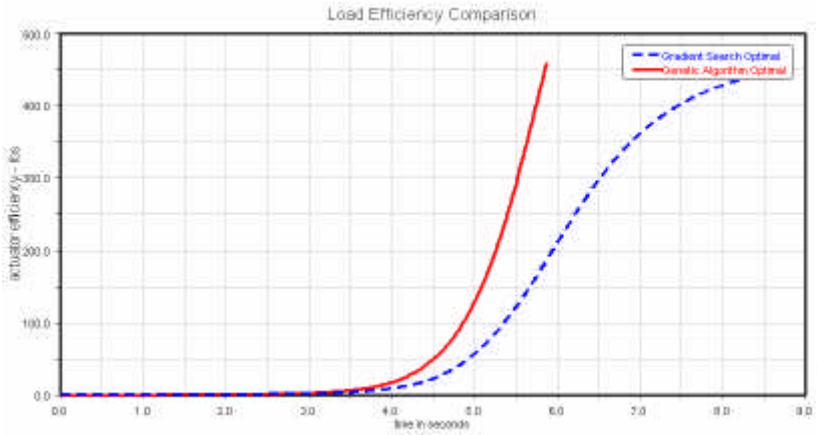
Initial Results Show Genetic Algorithm Found Better Optimal



Mechanical Dynamics

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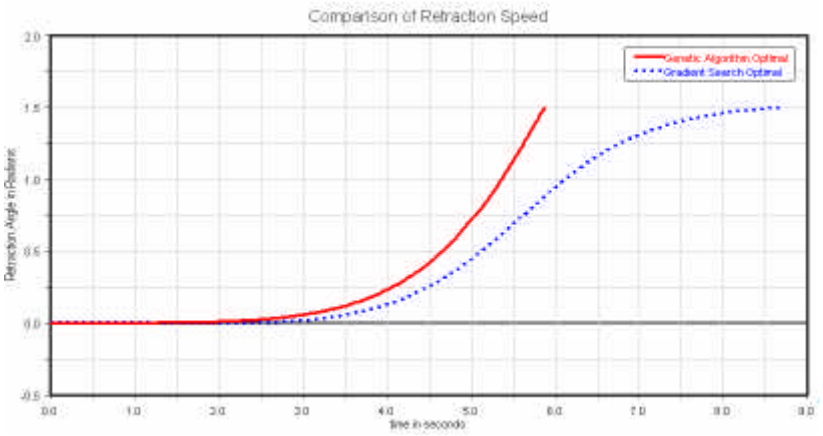
Initial Results Show Genetic Algorithm Found "Faster" Mechanism



Mechanical Dynamics

Comparison of Gradient Search with Genetic Algorithms for Nose Landing Gear