

## Application Examples of ADAMS to Following Mobile Carrier

### *Application Examples of ADAMS to Following Mobile Carrier*



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## Outline of the Product

- Produced by the order from a building maintenance company
  - Load transportation at the steps (height differences)
  - Easy operation
    - Simple and easy operation with a steering lever
  - Long time drive
    - Combination of crawler and wheel
- Other
  - Be able to carry max. 380L, 100kg
  - Safety function such as back surveillance camera and sensors

## Application Examples of ADAMS to Following Mobile Carrier

### Studied Subjects

- Calculation of interaction and property among parts such as wheel going up and down function
- Strength of parts such as crawler flame
  - ⇒ *I-DEAS*
- Check basic function such as max. load capacity
- Stability when entering to the steps obliquely
  - ⇒ *ADAMS*

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### *Simulation Items for ADAMS*

- Simulation when going up and down the steps
  - Evaluate max. load capacity
  - Check entering speed
  - Check influence of load collapse
- Simulation when entering steps obliquely
  - Evaluate max. entering angle


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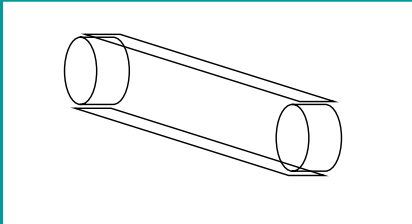
# Application Examples of ADAMS to Following Mobile Carrier


## Model

Physical Machine



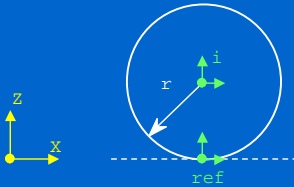
ADAMS Model





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## Definition of Traction Force

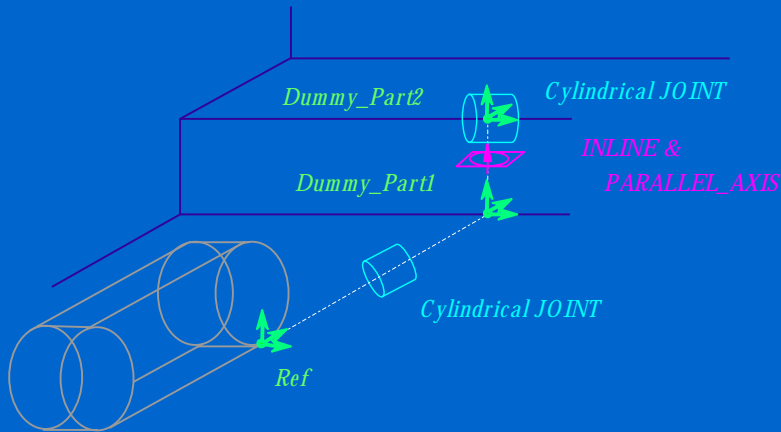


$$\begin{aligned}
 ty = & \text{STEP}(vx(imar,ref,ref) + dz(imar,ref,ref)*vy(imar,ref,ref) \\
 & , -\Sigma, 1, \Sigma, -1) \\
 & * \mu * \text{IMPACT}(dz(imar,ref,ref), vz(imar,ref,ref), R, k, e, C, d) \\
 & * (-dz(imar,ref,ref))
 \end{aligned}$$

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## Definition of Contact



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## Comparison with the experiment

- Check specification
  - Define conditions

➡ **No problem**
- Almost same as the simulation result

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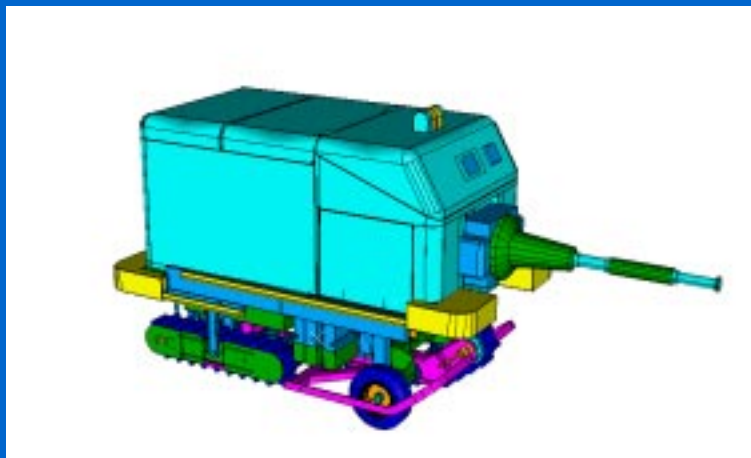
### Conclusion

- Improve design quality
  - Sufficient evaluation at product design stage
  - Even when experiments are difficult, various design studies are possible with ADAMS
- Shorten prototyping and evaluation time
  - Decrease number of physical prototyping

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### *Solid Models Using I-DEAS*

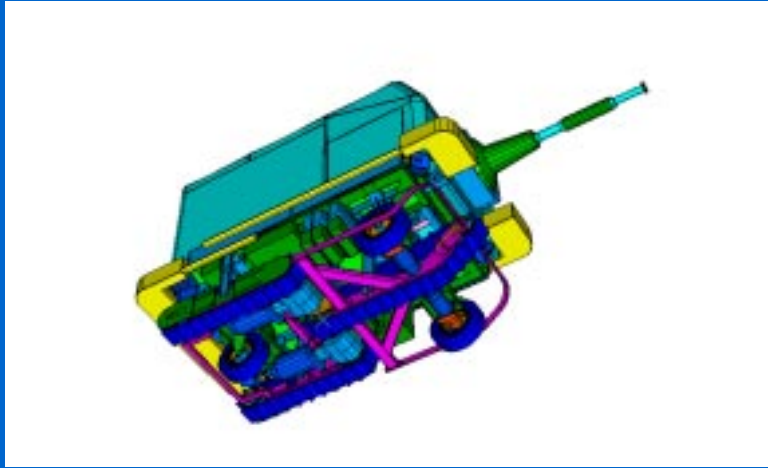


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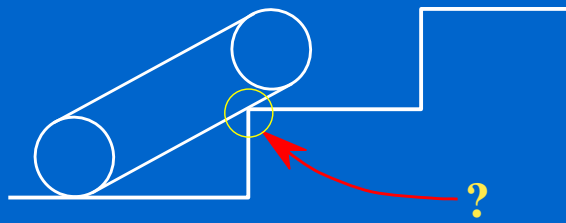
## *Solid Models Using I-DEAS*



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## Definition of Traction Force (2)



Same as the Definition of Traction Force (1)

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## Definition of Friction

*Vertical Reaction Force*

*Variable/1, IC=0,*

$F_{un} = \text{IMPACT} ( dz(\text{imar,ref,ref}) , vz(\text{imar,ref,ref}),R,k,e,C,d)$

*Sliding Speed*

*Variable/2, IC=0,*

$F_{un} = \text{sqrt}( vx(\text{imar,ref,ref})^{**2} + vy(\text{imar,ref,ref})^{**2} )$

*Size of Friction*

*Variable/3, IC=0,*

$\mu * \text{VARVAL}(1) * \text{STEP}(\text{VARVAL}(2) ,0,0,1e-2,1)$

*Friction Model(VFO)*

$\text{VFORCE1} , I= \text{imar} , J\text{float}=xxx , RM=\text{ref}$

$F_x = \text{VARVAL}(3) * (vx(\text{imar,ref,ref}) / \text{MAX}(\text{VARVAL}(2),1E-6)$

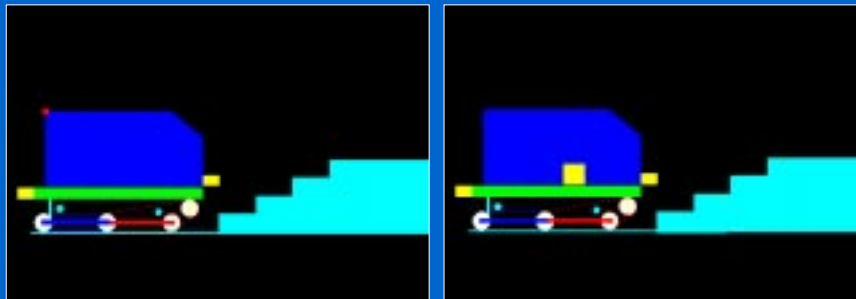
$F_y = \text{VARVAL}(3) * (vy(\text{imar,ref,ref}) / \text{MAX}(\text{VARVAL}(2),1E-6)$

$F_z = \text{VARVAL}(1)$

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## Simulation Result (2-D)

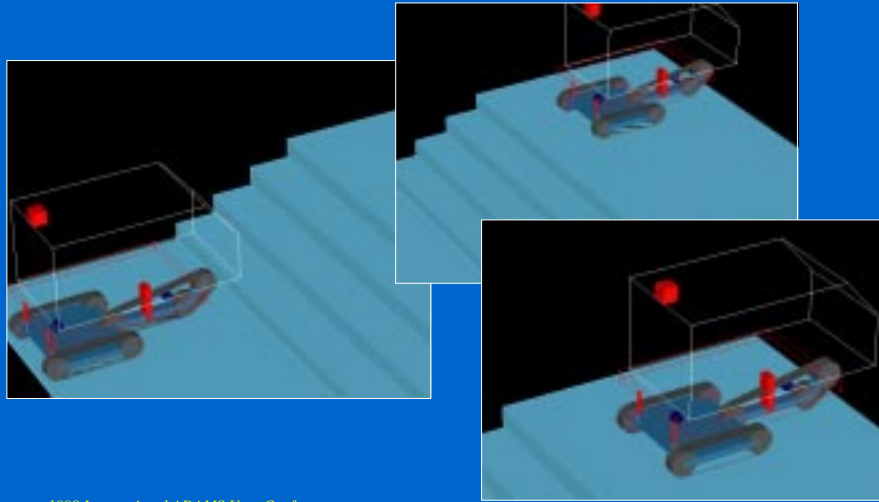


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# Application Examples of ADAMS to Following Mobile Carrier

## Simulation Result (3-D)



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