





3D Piston Secondary Motion

by Mike Bamford, Yeongching Lin - Ford Motor Company, Advanced Powertrain Division
& Yaquin Jiang, Brett Harris - MDI







**3D Piston
Secondary Motion**

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Agenda

- Objectives
- Approach
- Bearing Calculation
- Piston Flexible Model - NASTRAN
- ConRod Flexible Model
- Case Studies
- Results
- Future Work





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Objectives

- Model full piston motion inside the cylinder bore using flexible piston and connecting rod parts.
- Incorporate a fast pseudo 3D oil film bearing model for support of the piston on the wrist pin.



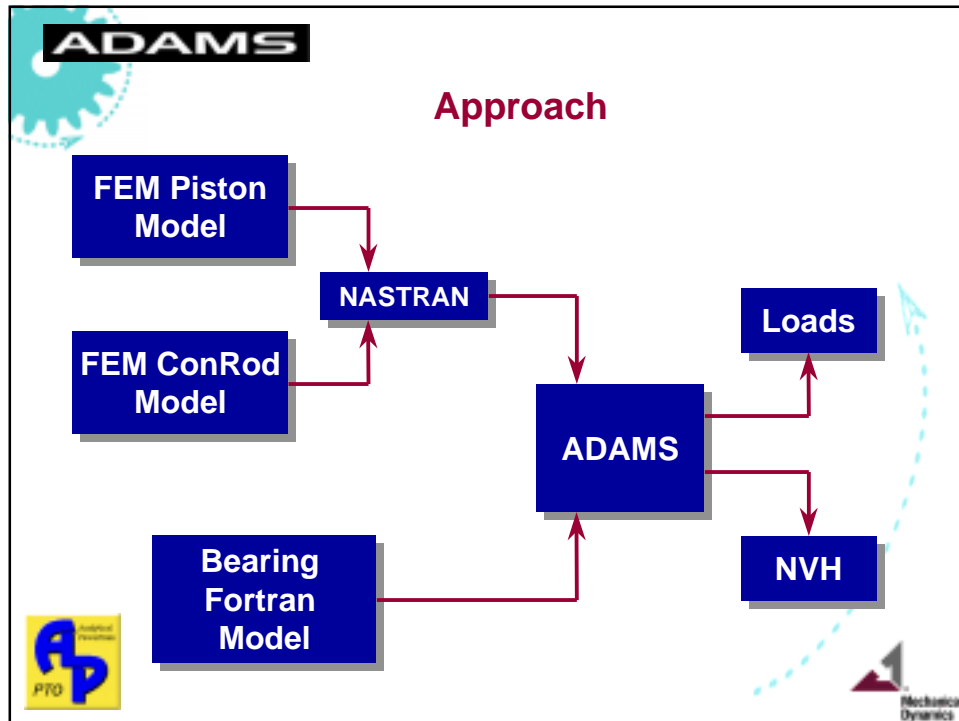
Approach

- The piston and conrod are modeled as flexible parts using ADAMS modal flexibility. The parts were automeshed in I-DEAS, then the modes were processed using NASTRAN
- The oil film bearing model is a GFO Sub.



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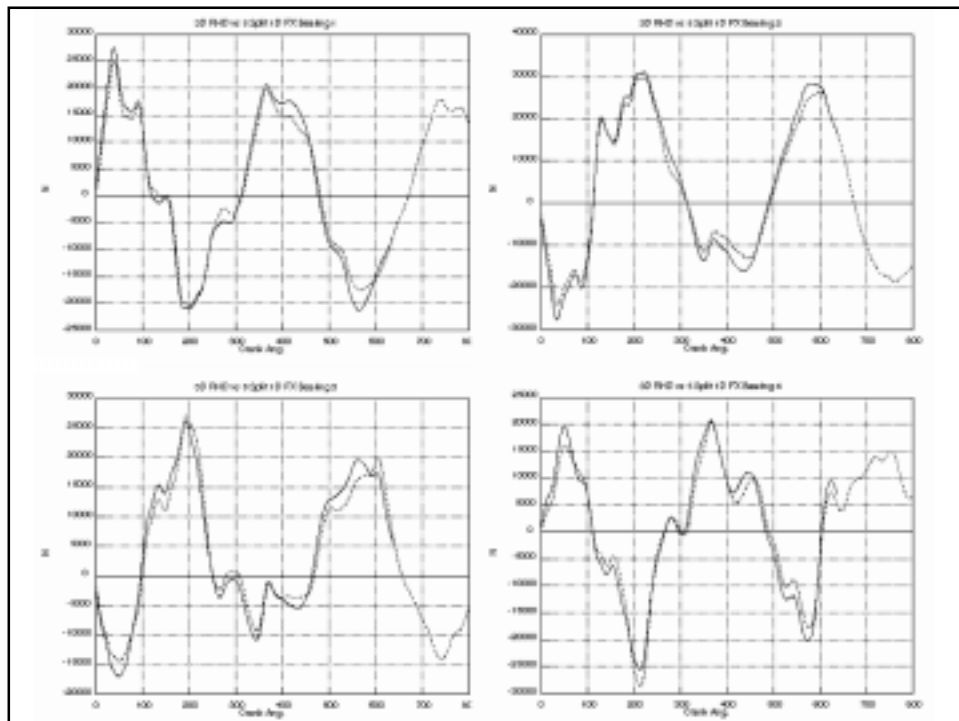
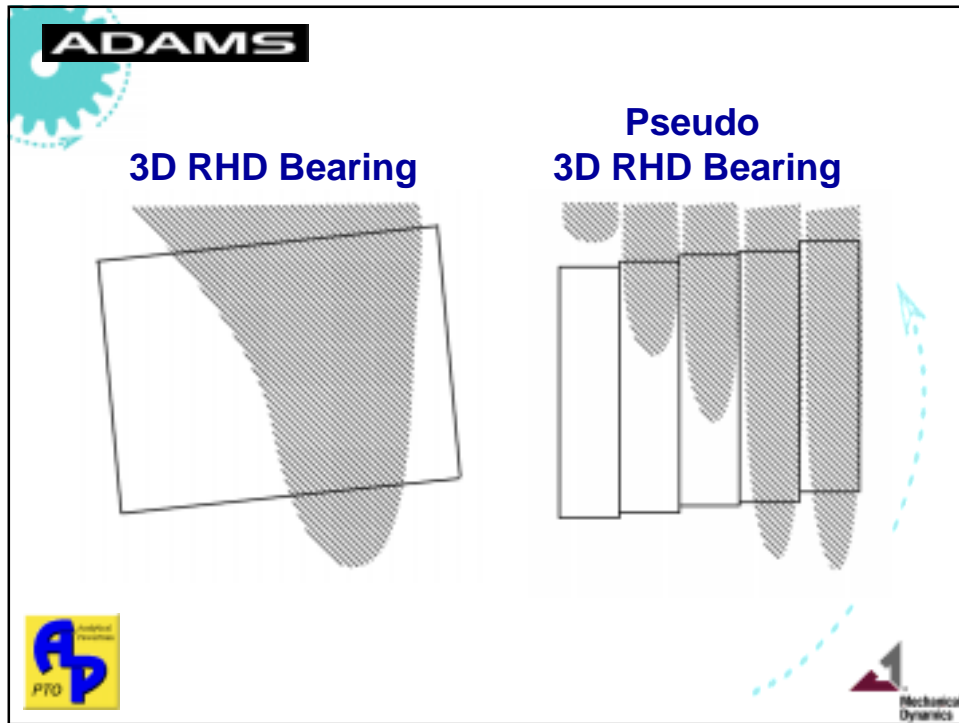
The text box, titled "ADAMS Bearing Models", lists three types of bearing models used in the simulation:

- Simple 1D planar bearing model using impedance formulation.
- Full 3D rigid hydrodynamic (RHD) model based on meshed bearing geometry using a finite difference method to solve the full Reynolds equation at each grid.
- Pseudo 3D bearing model uses the simple 1D model above with modified bearing geometry to calculate both forces and moments.

Logos for "AD" (Advanced Powertrain Division) and "Mechanical Dynamics" are present in the bottom corners.

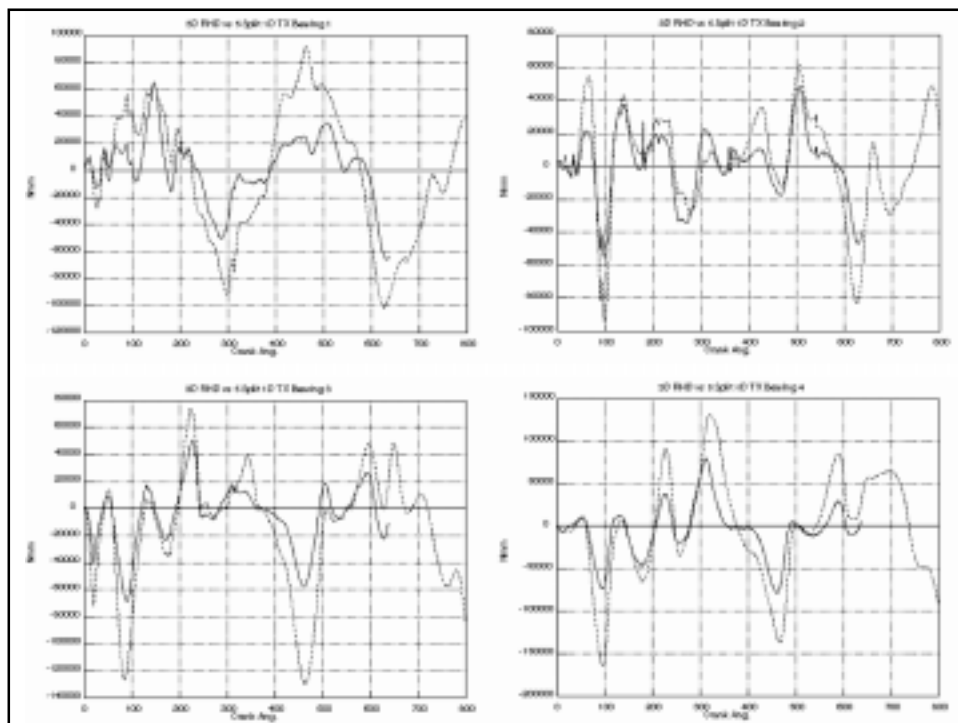
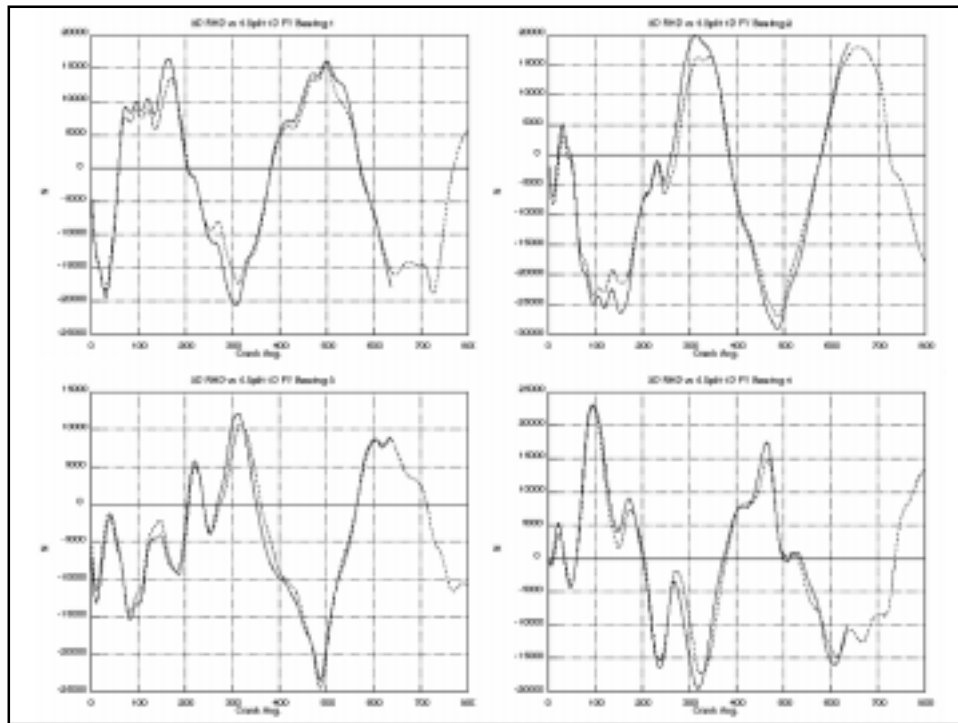
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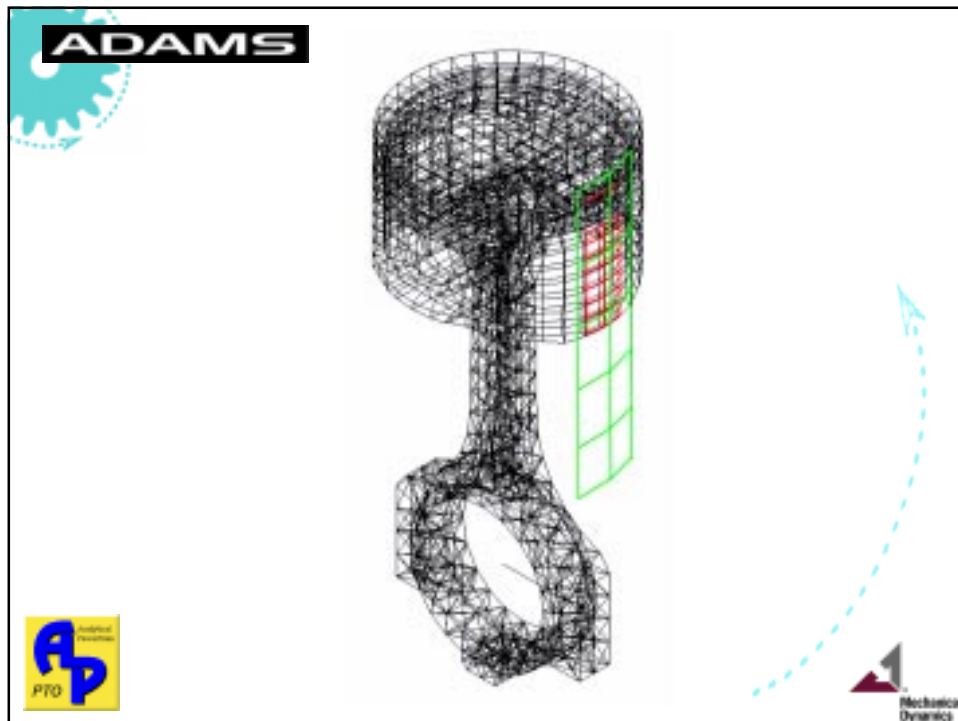
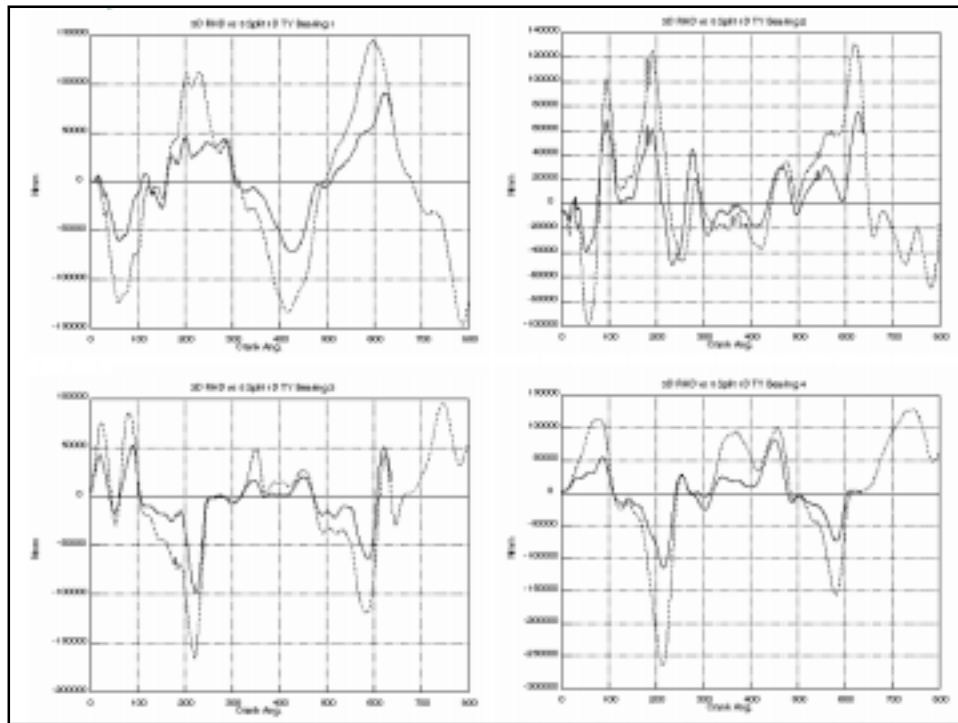
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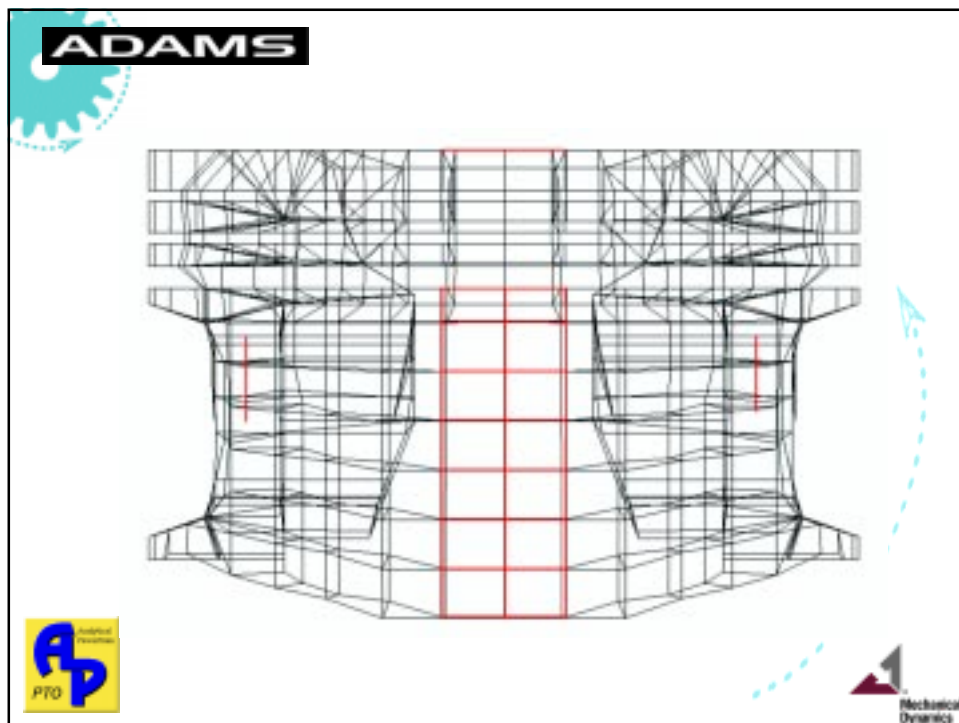
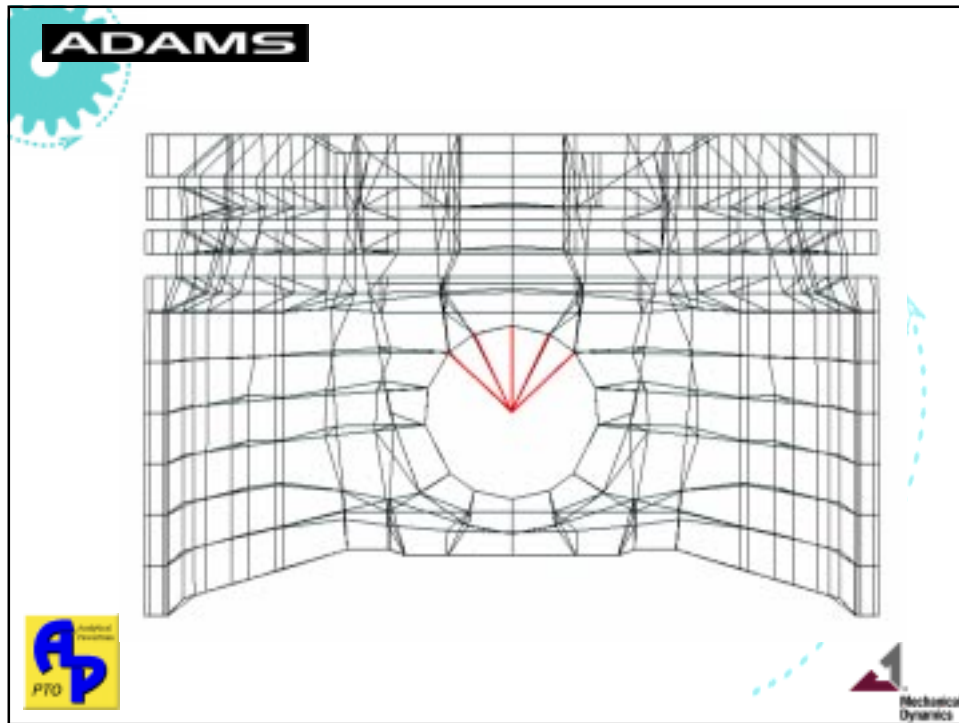
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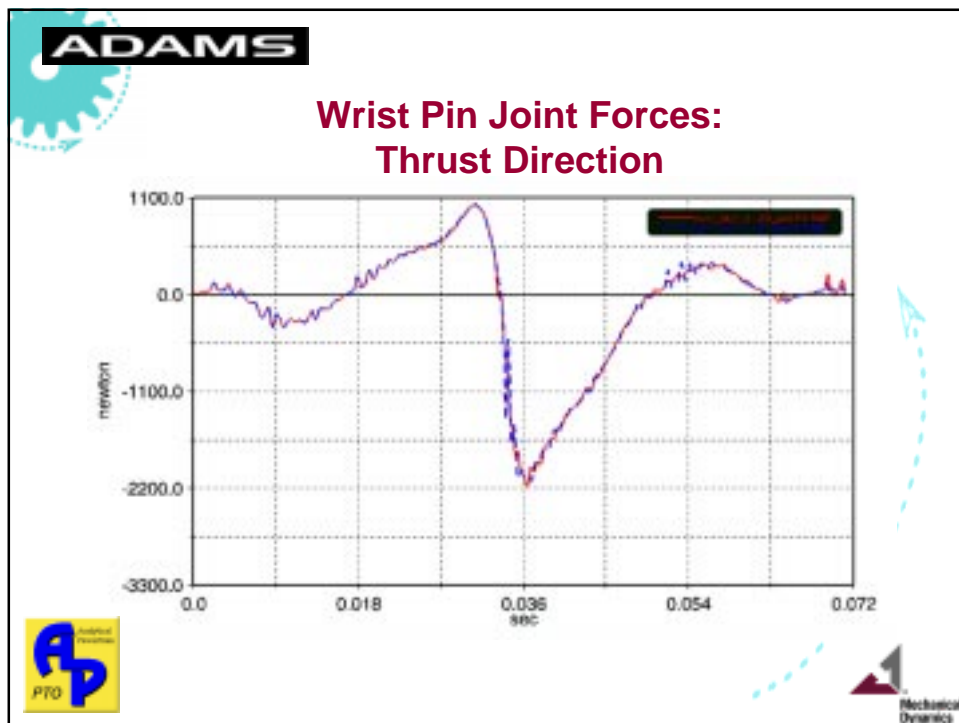
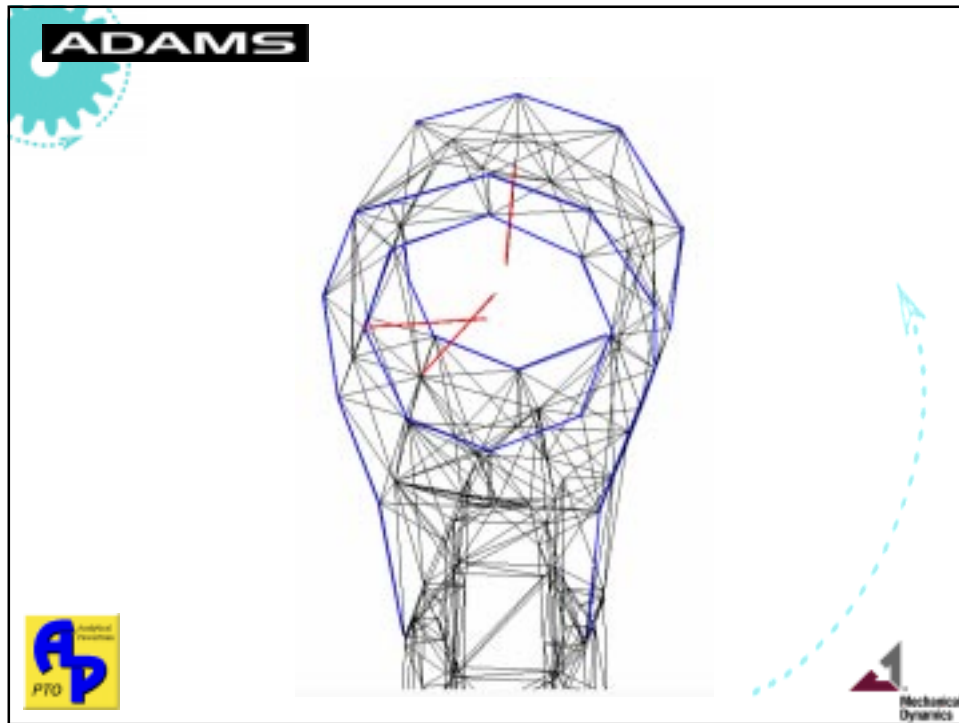
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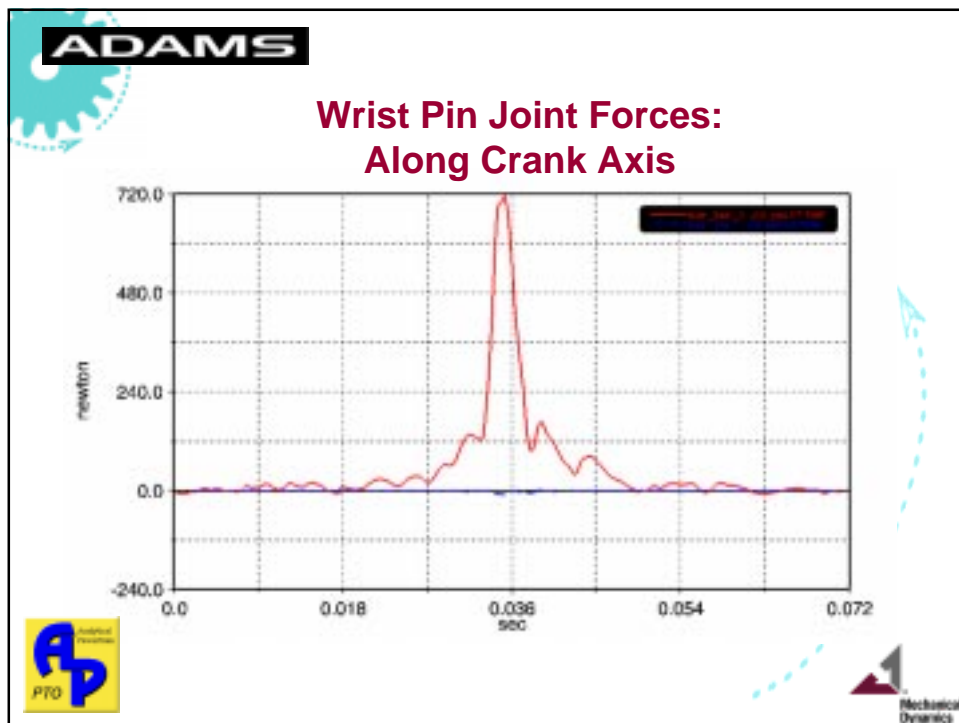
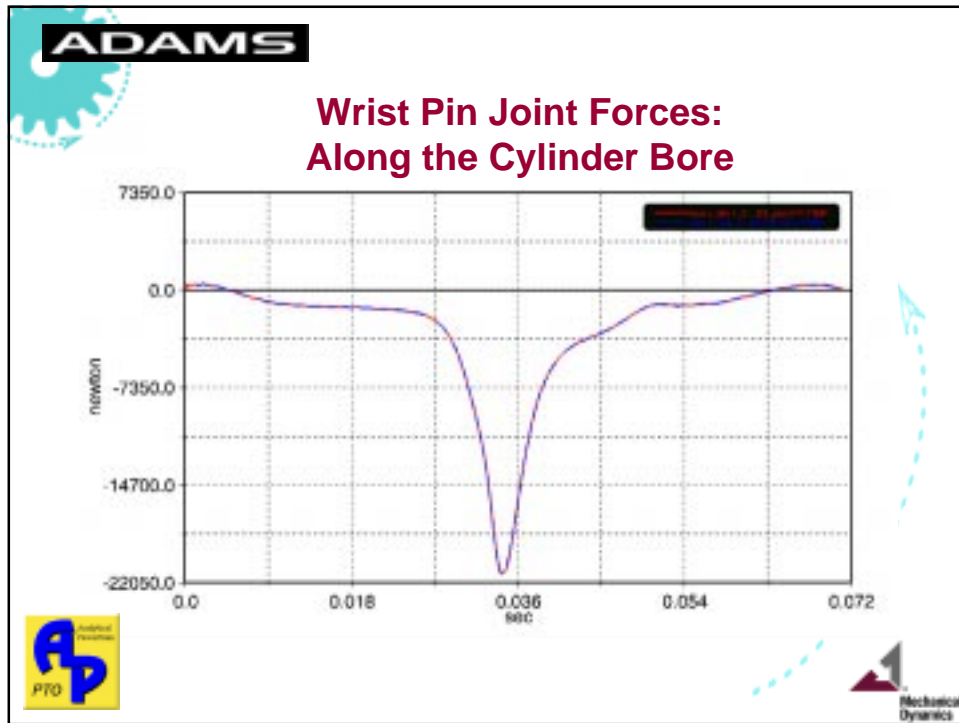
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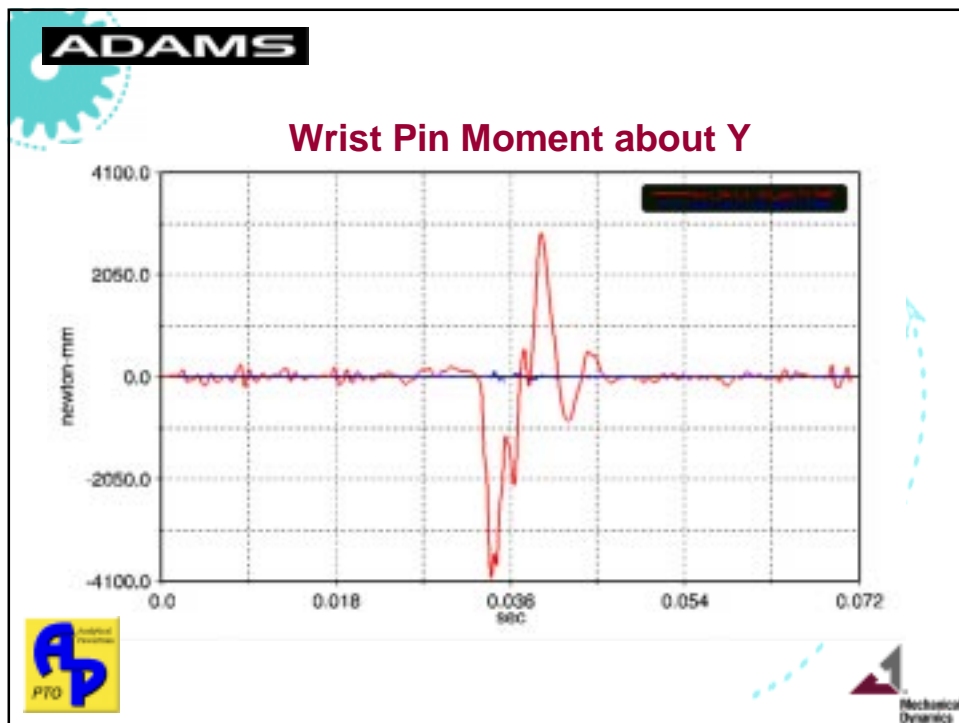
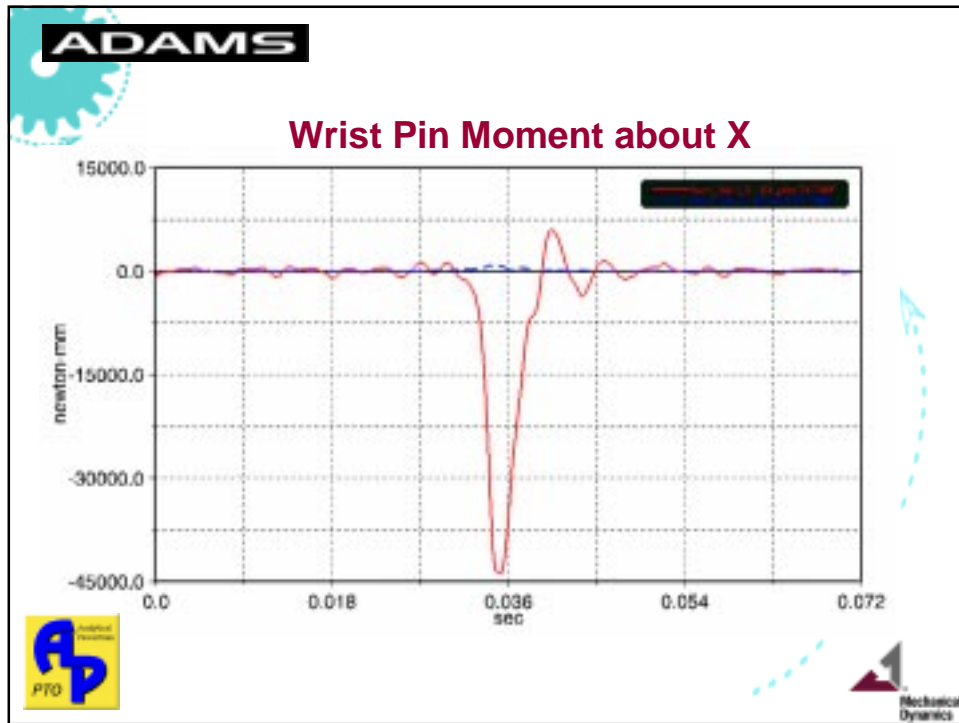
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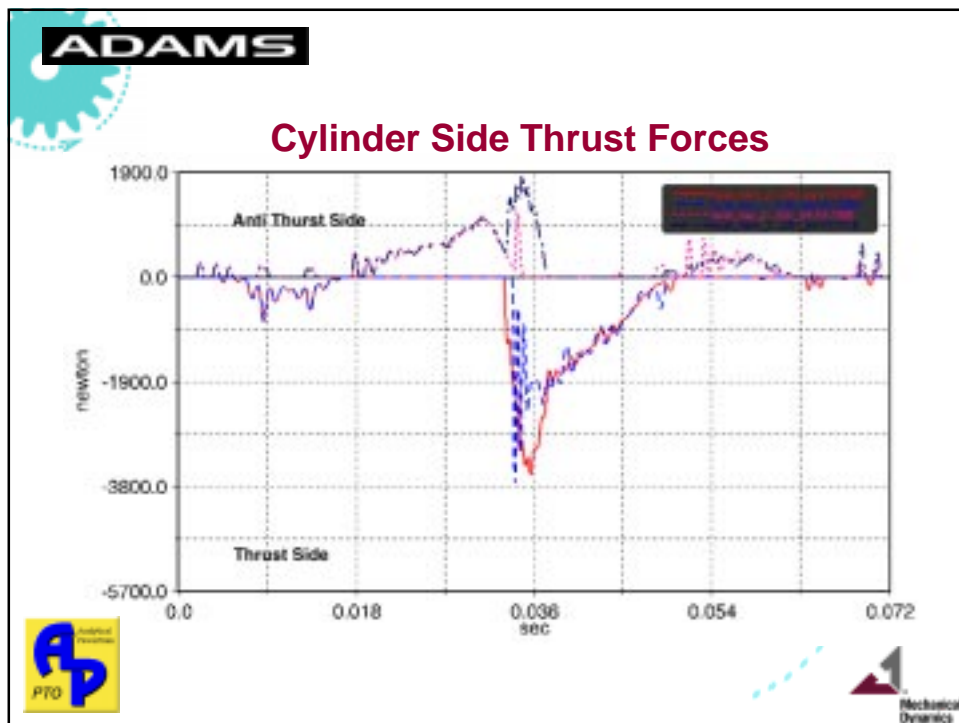
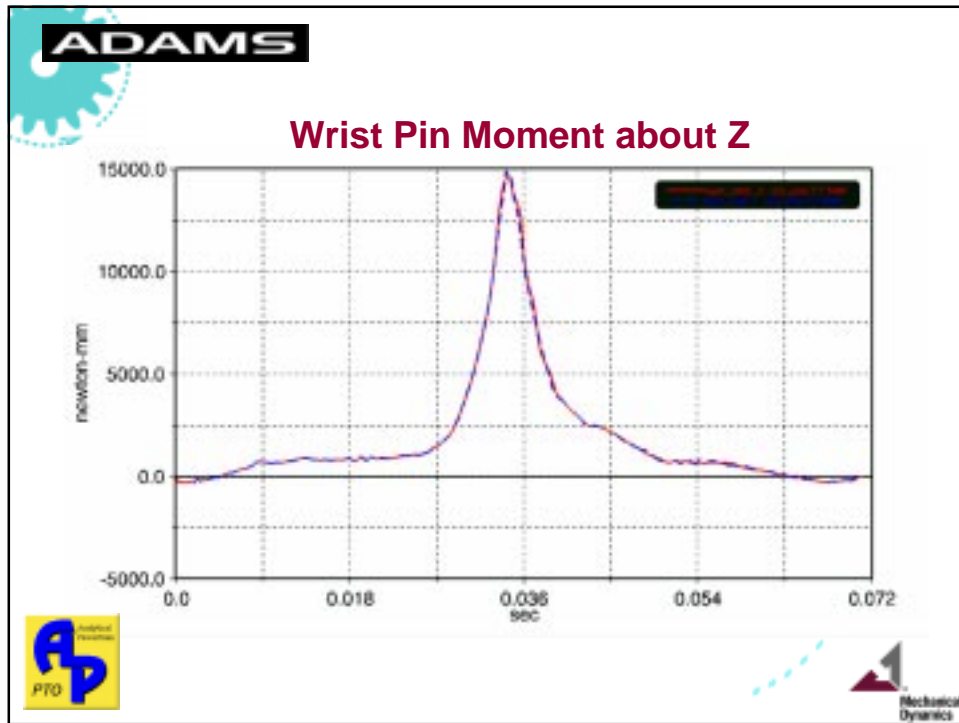
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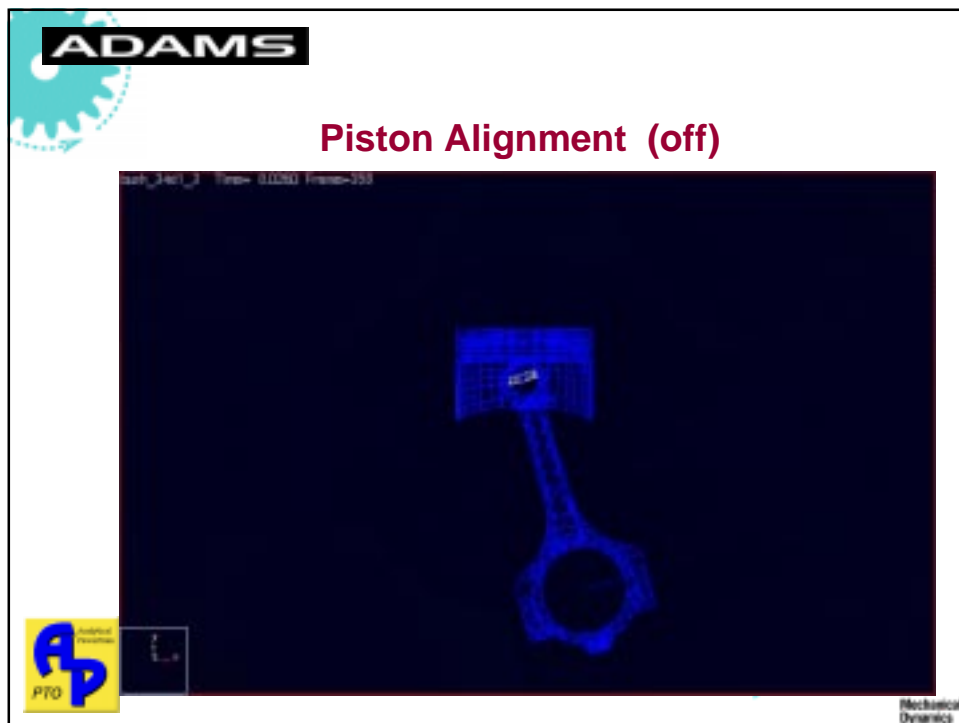
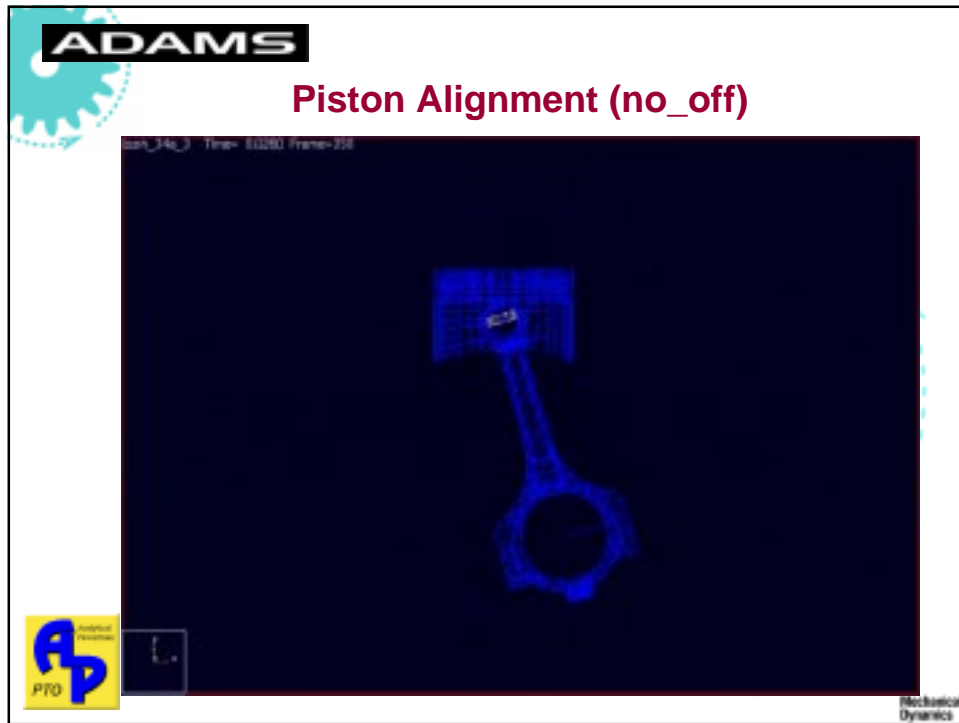
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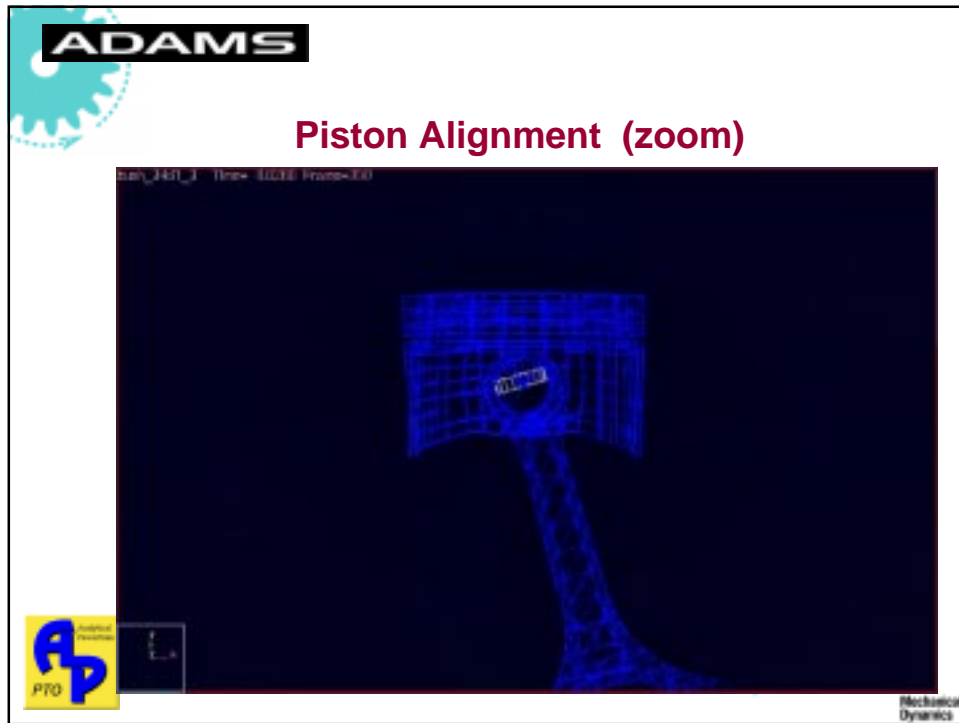
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Conclusions

- Piston - ConRod alignment is important
- Pseudo 3D-MultiSplit bearing modeling gives good results

The Virtual Engine is Coming

Available Modules:

Crank Train	Piston Slap
Valve Train	FEAD
Cam Drive	

APD

Mechanical Dynamics