Simulations up to 11000 rpm of a Radial 8 Piston Hydraulic Pump in SIMPACK

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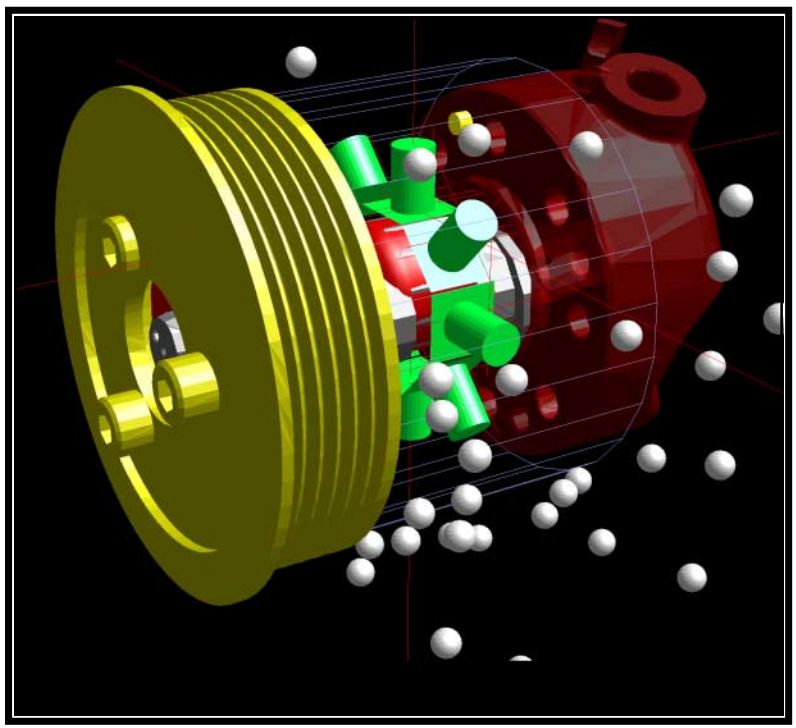
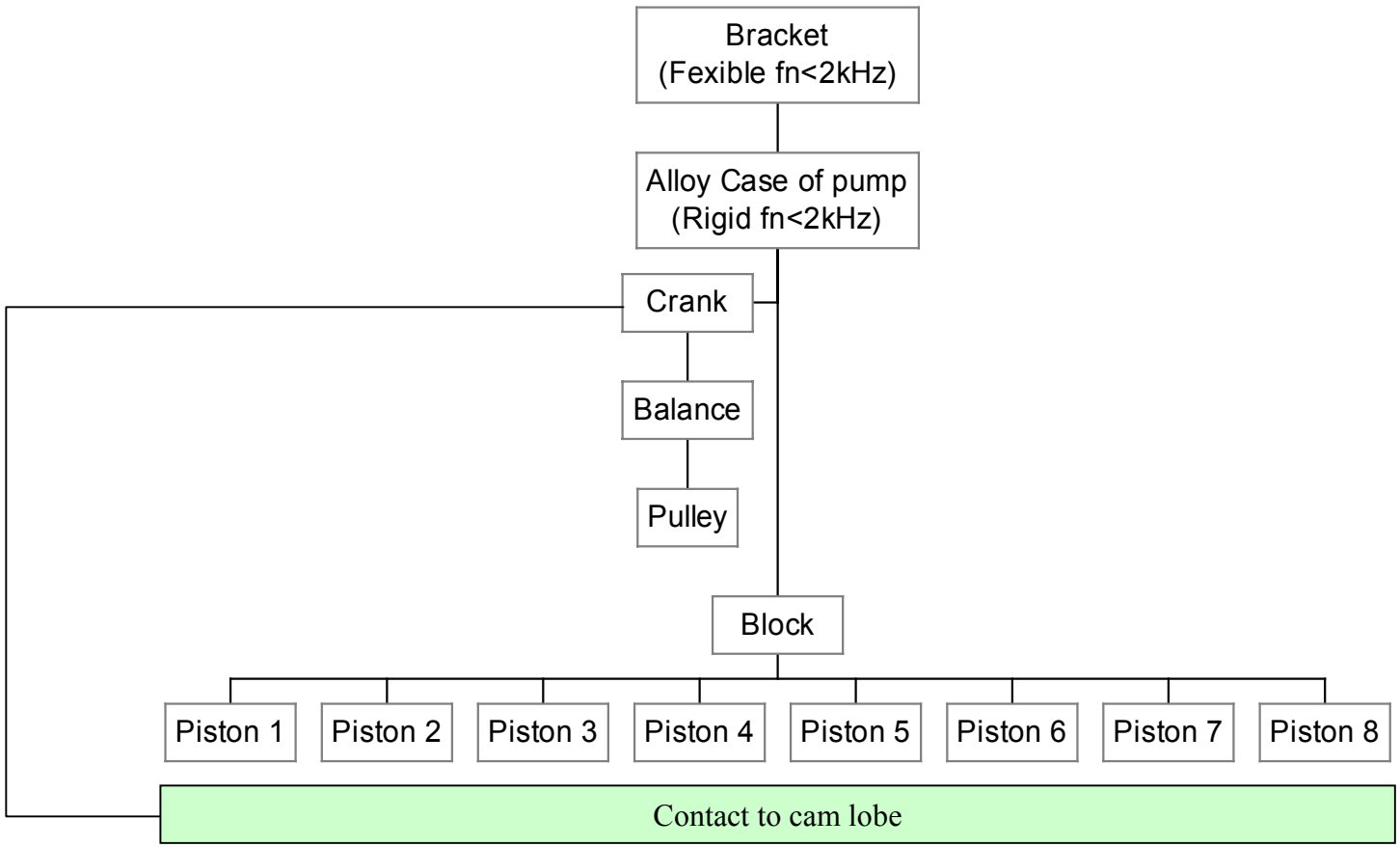
Model Setup

- 8 pistons with full contact onto the driven cam.
- Piston pressure profile applied to each piston dependant on piston position in the bore from measured data.
- Flexible mounting bracket of the pump to capture bracket resonance's
- Piston to bore viscous / friction properties accounted for
- Runs up to 11000 rpm at a data output rate of 5 kHz



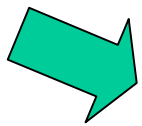
Model Topology



Model Solution

Analysis requirements

•Shaft Speed 11000 RPM
•Output f_{max} 5 KHz for audio



SIMPACK

Machine

•Dell 530 workstation

•Twin 2.4 GHz XEON processors

•4 Gb RAM

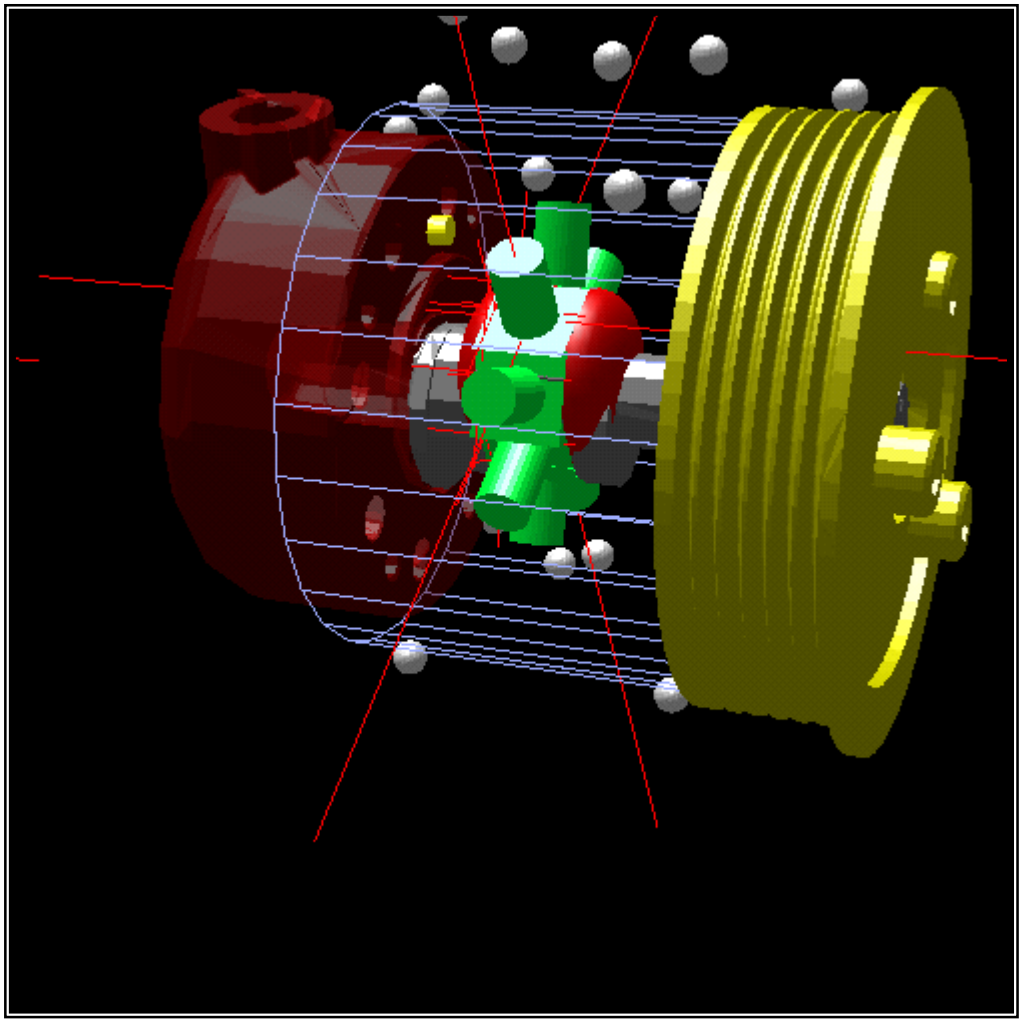
•120 Gb SCSI DISCS

Solution Time

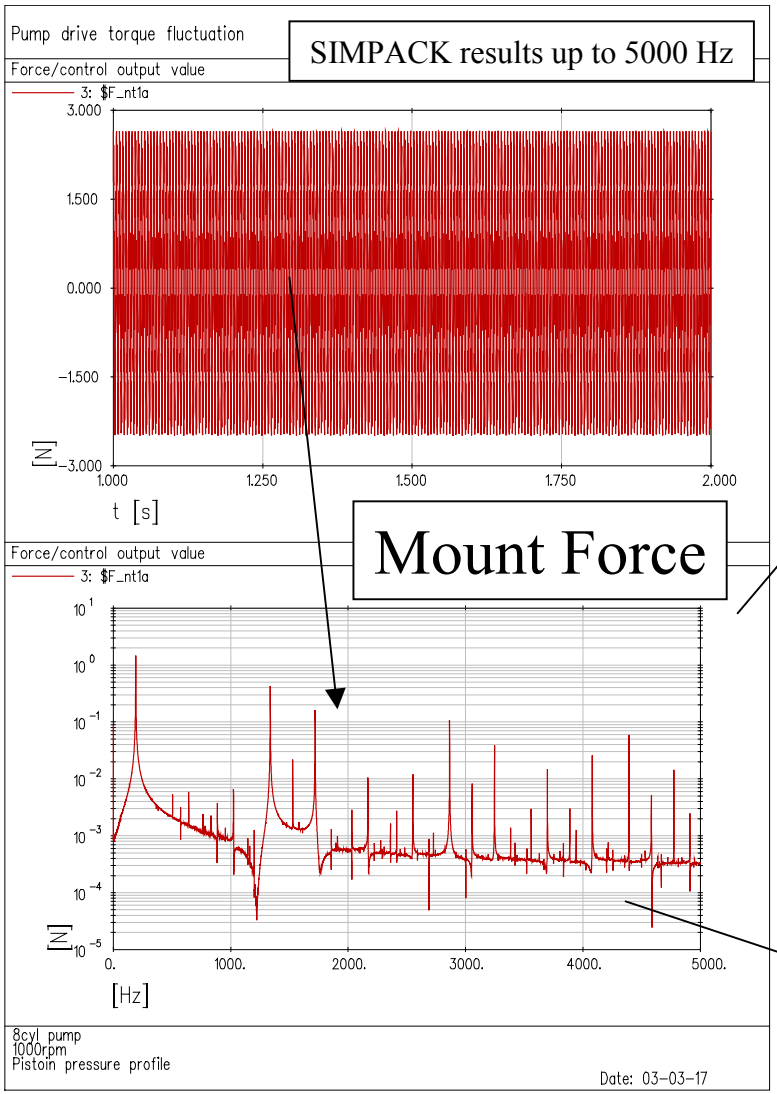
•50 second run up
= 120 minutes

•10 seconds idle (1000 rpm)
= 25 minutes

Model Animation



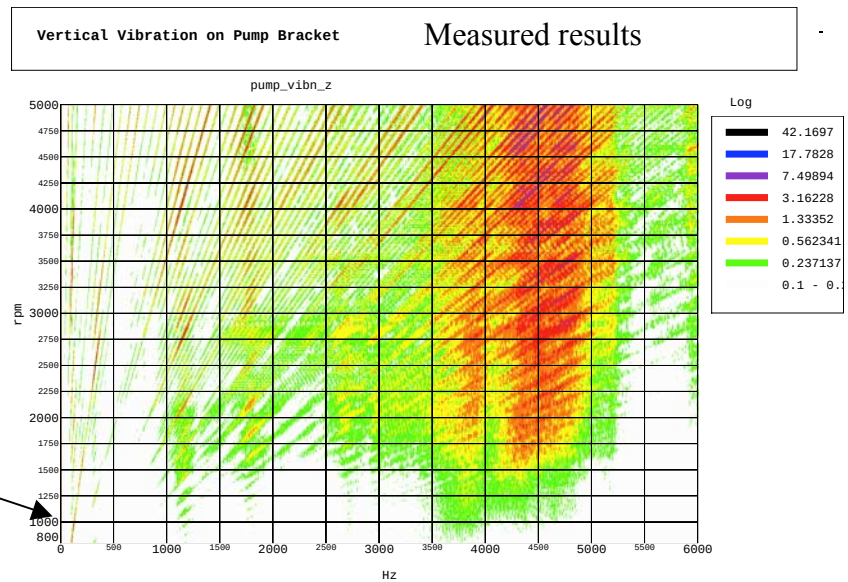
Model Results



SIMPACK results up to 5000 Hz

Mount Force

Generate wave file with MATLAB



Audio results

	1000 rpm No Load	1000 rpm No load No Fluid	Run up
Simulated	Sim_1000_noload.wav 	Sim_1000_noload_nofluid.wav 	Sim_runup.wav 
Measured	Meas_1000_noload.wav 	Meas_1000_no_fluid.wav 	Meas_runup.wav 

Conclusions

- Reasonable correlation of audio quality up to given frequency output.
- Measured data contains higher frequency content that is not yet captured by the model.
- Force data generated from SIMPACK will be used to generate drivers ear noise based on NTF's taken from measured vehicles.

Next Steps

- Implement valve mechanism to introduce the higher frequency content from the pump
- Mounting bracket optimisation to reduce the drivers ear noise levels.
- Write a user routine to accurately apply the piston pressure for a variety of system pressures and running speeds.