VDOP GT-SUITE MODEL
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SUMMARY

1. Objective
2. Oil pump
3. Gt-suite model
   • Gem 3d
   • Model
   • Parameters
4. Results
   • Pump behavior
   • Experimental vs Simulation
   • Porting Shape influence
   • NVH (Previous)
5. Conclusions
OBJECTIVE

Develop a Variable Displacement Oil Pump model in GT-Suite:

- Evaluate the pump behavior:
  - Oil Pressure
  - Volumetric Flow
  - NVH

- Different Conditions:
  - Temperature
  - EV mode: On or Off
  - Rotational speed
Variable Displacement Oil Pump with electro valve
3. GT-SUITE MODEL

GEM3D

1. Import 3D Model
2. Define the components
3. Discretize and Open in GT-ISE
Model:
1. Inlet Volume
2. Outlet Volume
3. 7 chambers
4. Control Valve
5. Electric valve

Model developed with Gamma Technology:
Rodrigo Aihara and Haitham Mezher
3. GT-SUITE MODEL

SIMULATION PARAMETERS

- Temperature
- EV mode
- Rotational speed
- Outlet Diameter ➔ Pressure regulation
- Internal leakages
4. RESULTS

PUMP BEHAVIOR

Vane Geometry

- 7 Chambers

Volume Profile

Chamber 1

- Min. volume: ~180°
- Max. volume: ~0°

Volumetric Flow

- Volumetric flow behavior reflect the effect of the 7 chambers.
4. RESULTS

PUMP BEHAVIOR

Average Pressure

T=20ºC, EV OFF, RPM 2000

- Low pressure zone:
  - Inlet region
  - Chamber in contact with inlet

- High pressure zone
  - Outlet volume
  - Chamber in contact with outlet
4. RESULTS

EXPERIMENTAL vs SIMULATION

- The pressure vs volumetric flow behavior is similar to the experimental,
- EV OFF: GT results have a good correlation with the experimental values,
- EV ON: The correlation is not so good for the pressure regulation.
4. RESULTS
PORTING SHAPE INFLUENCE

Porting shape configuration

Outlet

Inlet

Were evaluated 2 cases:
- PS 1
- PS 2

• The pressure behavior for the PS 1 configuration is more stable than for PS2, which exhibits a few peaks
• Volumetric flow: PS 1 configuration have a more stable behavior
4. RESULTS

NVH PREVIOUS RESULTS

Model with an FFT component

FFT Amplitude → dB analysis.

The coherence between GT results and experimental values is under analysis!
CONCLUSIONS

- The GT pump model allows a pump characterization for the different conditions: pressure, volumetric flow, eccentricity, ...
- The model behavior for EV ON mode needs to be optimized
- The simulation supports the product development and modification, evaluating the impact of parameters modifications
- Future Work: NVH characterization
THANK YOU