Modeling a Refrigeration Compressor with GT-SUITE


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Compressor Applications

Reach In
Display Case
Cold Room
Milk Tank
Ice Maker
# Combustion Engine x Compressor

<table>
<thead>
<tr>
<th>COMBUSTION ENGINE</th>
<th>COMPRESSOR</th>
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<td><strong>OUTPUT</strong></td>
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<tr>
<td>Torque Generation</td>
<td>Gas Compression</td>
</tr>
<tr>
<td><strong>DRIVING FORCES</strong></td>
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<tr>
<td>Gas Expansion</td>
<td>Electric Motor</td>
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<td>(Chemical Reaction)</td>
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<td><strong>VALVES CONTROL</strong></td>
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<tr>
<td>Commanded System</td>
<td>Flow Forces</td>
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<td><strong>MAIN MECHANISM</strong></td>
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<td>Crank Piston</td>
<td>Crank Piston</td>
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</table>
Objective

- Investigate the influence of different levels of discretization of 3D components comparing Simulated and Experimental results.
Motivation

Absolute Error
| Simulated – Measured |

Level of Discretization

Accuracy
Processing Time

1D Simulation

CFD Simulation

3D GT TOOLS
Space Claim
GEM-3D
System - Compressor

- Suction Muffler
- Suction Valve
- Compression Chamber
- Discharge Valve
- Cylinder Head
- Discharge Mufflers
- Shock-loop
Model - Discretized Components
Suction Muffler – 3 Models
3D Components

Levels of Discretization

CAD Model | AAA | AAC | CCC
---|---|---|---
A | (2) | (5) | (1)
B | (1) | (7) | (2)
C | (18) | (6) | (3)

- Suction Muffler
- Cylinder Head
- Discharge Mufflers
Simulated vs Measured

GT Conference 2014 - Birmingham, Michigan
November 03-04
Levels of Discretization

CAD Model

Cylinder Head

1. Cylinder Head: 1 Element Model
2. Cylinder Head: 4 Element Model
3. Cylinder Head: Experimental
4. Cylinder Head: 18 Element Model

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Simulated vs Measured

1st DISCHARGE MUFFLER ($P_4$)

Pressure [kPa]

Crank Angle [deg]
Simulated vs Measured

2nd DISCHARGE MUFFLER (P₅)

Crank Angle [deg] vs Pressure [kPa]

- CCC
- EXP
Conclusions

- Discretization showed no effect on Suction Muffler results,
- Discharge Muffler results were improved due to the discretization,
- Results of one component may be affected by the discretization of another component,
- Higher levels of discretization better describe high frequency pressure pulsation phenomena,
- Appropriate levels of discretization may be applied depending on the subject of the analysis.
Thank you for your attention. Questions?