HPC for automotive industry
Renault Nissan
A FRENCH GROUP TO SERVE A STRONG INTERNATIONAL STRATEGY

AN AUDACIOUS AND PASSIONATE COMPANY

RENAULT, A BRAND SOLD IN 125 COUNTRIES

2 118 844 VEHICLES SOLD IN 2014

HPC User forum
Eric Landel

12 October 15
RENAULT: A VIBRANT, CONNECTED TO PEOPLE AND FORWARD LOOKING BRAND
CARS FOR LIVING LIFE TO THE FULL
### 5 CHALLENGES for Renault

<table>
<thead>
<tr>
<th>CUSTOMER</th>
<th>Target</th>
</tr>
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<tbody>
<tr>
<td>Safety</td>
<td>0 injuries</td>
</tr>
<tr>
<td>Environnement</td>
<td>0 impact</td>
</tr>
<tr>
<td>Driving Pleasure Life on Board</td>
<td>0 stress</td>
</tr>
<tr>
<td>Affordability</td>
<td>0 Left out</td>
</tr>
<tr>
<td>Mobility system</td>
<td>0 flaw</td>
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</tbody>
</table>

Numerical simulation is very helpful for developing and introducing new technologies.
3 main domains for HPC:

1. Crash (passive safety)
2. Aerodynamic (environment)
3. Combustion (environment)
Compute Power vs. Number of Years

\[ Q(y) = Q_0 \cdot 2^{(y/Y)} \]

2004 NEON-04 9M & 2006 Toyota 11M

Optimistic Moore:
\[ Y = 1.5 \text{ Years} \]

Pessimistic Moore:
\[ Y = 2.0 \text{ Years} \]
Moore’s Law 2013: DACIA Lodgy

- 20 000 000 Polo
- 3 600 Polos
- 42 TGVs

- Polo 5 555
- 5 555 shells

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External aerodynamic:

- Accurate prediction of Drag coefficient
- Analysis of wake

<table>
<thead>
<tr>
<th></th>
<th>SCx</th>
<th>Ecart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expérimental</td>
<td>1.016</td>
<td></td>
</tr>
<tr>
<td>LaBS</td>
<td>1.010</td>
<td>-1%</td>
</tr>
</tbody>
</table>
Aero thermal behavior in the engine compartment

- Transient case: detecting constraining regions during transient case (natural convection) and quantifying the increasing of temperature
Powertrain description: Fluid dynamic for powertrain designing

Combustion chamber designing:
- Internal aerodynamic
- Injection
- Combustion
- Pollutants emissions

Implementation of aftertreatment systems:
- Designing of the diffusor
- Implementation of urea injection

Thermal behavior:
- Cooling efficiency in water jacket
- Impingement efficiency on power unit

Gear box lubrication:
- Designing of the collector
- Efficiency of the lubrication

Base engine lubrication:
- Aeration

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Powertrain Continuum mechanics description: Close future

Development of the gear box lubrication

Cylinder cycle to cycle calculations

Time = 4.02 CA
Investment: PRACE is a very helpful support for right investment

For evaluation, development and implementation of new methods, large resources are needed.
Thank you for your attention