Exhaust Streams and Component Heat Protection

Tim Viola
Exhaust Streams and Component Heat Protection

• Exhaust Stream Feature
• Hot components in an engine compartment
• Updates from 12.4 to 12.5 ease exhaust stream setup
• Implement a fix to resolve the issue
• Unrealized effects of the implemented fix
The Task at Hand: Evaluate packaged components in an engine compartment that could potentially be getting too hot
Model Scenario

1. From a cold/off state of 20°C

2. The vehicle turns on

3. Set to run for a 30 minute transient case @ 120 kph
Thermal Model Heat Contributors

- Engine
- Cooling pack
- Transmission
- Exhaust components
ThermoAnalytics’ exhaust stream feature is used to model convection correlations and heating within the exhaust components.
Exhaust Tool Improvements from 12.4 to 12.5

• Sub-streams can now be categorized as being one of three types:
  • Single inlet, single outlet (SISO)
  • Multiple inlet, single outlet (MISO)
  • Single inlet, multiple outlet (SIMO)
Exhaust Stream Updated Model Setup

• Model setup is simplified with the feature improvements
  • Components: 18 > 11
  • Stream points: 22 > 13
  • Number of Sub-Streams: 17 > 2

• Model now only requires 2 Sub-Streams
  • 1 MISO
  • 1 SIMO
Thermal Model: Exhaust Stream
Battery, fuse box, and fluid reservoirs exceeding threshold

Design temperatures for packaged components set to 100°C
Substitute a double-walled exhaust pipe from the turbos to the catalytic converters.
Add insulation to the hot side of the turbo
Maximum Design Temperature

Baseline

Double-walled exhaust pipe w/ insulated turbo
Unexpected rear bumper temperature
Other Fixes to Consider

- Adding insulative layers was just one of many solutions
- Many others could easily be implemented
  - Add double-walled exhaust pipe
  - Insulate additional exhaust components
  - Re-direct ambient air flow
  - Change the surface emissivity of the components and/or exhaust
  - Change surface emissivity on the exhaust
  - Add shielding geometry
  - Translate critical components further from heat sources
  - Re-route exhaust pipe (would require geometry change)
  - Multiple fixes at once
Conclusions

• TAITherm is well suited to assess component temperatures in a vehicle model
• The exhaust stream feature can handle convective heating in an exhaust network with minimal required model setup
• Exhaust stream modeling has been simplified, resulting in easier model setup
• TAITherm 12.5 will be available December 12!
  • Advanced exhaust stream post processing features
  • Thermal links enhancements
Questions?

Thank you for attending!
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