Brake System Design for commercial vehicles

BME Department of Automobiles offers system design services for a vehicle manufacturer.
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Introduction

History:
A dedicated group was established at summer of 2009 in order to support the Department of Automobiles in his external activity with regard to vehicle development.

Target:
- Extend cooperation between University and Industry
- To establish joined activity with the vehicle manufacturers in the development of their future vehicle products. The Department - extended with the team - can offer this competence mainly in brake systems, together with other electronic vehicle subsystems.
- The Department offers a know-how which could be developed by vehicle manufacturer only through bigger investment on site.
- Moreover product guide courses, more level training about the designed system can be held at the manufacturer.
System design process 1

- Requirement Specification
  - Collect and document customer, market and legal requirements
- System definition and calculation
  - Define system layout
  - Define components, for own design and also from suppliers
  - Calculations on system level (using software developed partly in the project)
    - Service brake system performance
    - Compatibility between towing and towed vehicle
    - Parking brake calculation like Reservoir capacity calculation
    - Air supply system
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System design process 2

- Packaging design
  - 3D design of structure and installation - Packaging of components
  - Piping, fitting design
  - Design of brackets
  - Optimization of layout
  - Manufacturing documentation

- Engineering calculation
  - Fastness calculation
  - FEM calculation
  - Fatigue lifetime calculations
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System design process 3

- Testing
  - Vehicle simulation (Matlab)
  - Prototype building
  - Module testing, verification
  - Bench test, Vibration test,
  - Vehicle test
- System specification
  - Create documentation of results
- Support of introduction
  - Support customer in testing
  - Homologation, certification
  - Support customer documentation
- Training
The following examples will present our completed activity for a truck manufacturer and the benefits of our design concept.
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Design concept: Modular system approach

Example 1

- System built from modules
  - Pedal unit (or DCM)
  - Air treatment module
  - Rear axle module

- Advantages
  - Shorten assembly time
  - Pre-assembled, pre-tested units delivered to assembly line
  - Simplifies logistic
  - System responsibility at the supplier
Technical details of modules

Example 2

- Driver Control Module (as system element)
  - Steering wheel
  - Switches, levers on steering wheel and upper steering column
  - Steering wheel position adjustment
  - Brake pedal with valve
  - Clutch pedal with master cylinder
  - Accelerator pedal
- Air Treatment Module (ATM): (SD example)
  - Battery box used as frame
  - Air reservoirs
  - Air dryer with MCPV
  - Purge tank (option)
  - Trailer Control Valve
- Rear Axle Module (RAM): (SD example)
  - Service brake relay valve
  - Parking brake relay valve
  - ABS valves
  - Optional ASR valve
Packaging design – piping

Example 3

Scope for improvement of piping

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Packaging design – piping

Our proposal including Air Treatment Module, Rear Axle Module and an optimized piping layout
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Benefits

Example 5

Our proposal gives remarkable savings in material and time for pre- and final assembly

- Final Assembly Time
- Pre-Assembly Time
- Total length of piping (m)
- Fittings
- Screw connections fitted in Final Assembly
- Pneum. connections fitted in Final Assembly
Packaging design - 3D

RAM (Rear Axle Module) concept for low floor buses:
Complex module including the following functions:
- Relay function for service brake
- ABS and ASR function for service brake
- Relay function and select low valve for parking brake
- Door opening function with pressure limitation
- ELC function (Electronic leveling control)
- MCPV (multi circuit protection valve)
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Summary

- Technical University Department of Automobiles offers system design services for commercial vehicle manufacturers.
- Department of Automobiles applies the latest technology and utilizes the know-how provided by the University.
- Engineers with industrial experiences are employed in order to be able to turn the result of latest researches into the practice on an effective way.
- The development is process-orientated fulfilling the highest requirement of today automotive industry.
- The cooperation with TU offers also the possibility of trainings for the employees of vehicle manufacturer.