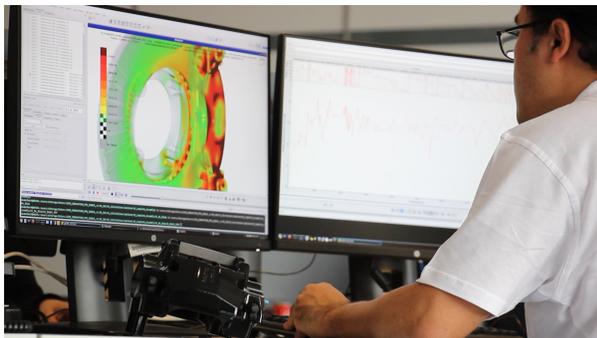


## Brakes Design

Applus IDIADA's Braking Systems design team is made of **multidisciplinary brakes engineers** with experience from a wide range of industry backgrounds. **Flexibility in adapting to specific customer requirements and local on-site support around the world** are assets which are driving Applus IDIADA's Braking Systems Design and Development projects.



OEM-oriented design conception with leading competences for **full-vehicle development projects**:

- Brakes dimensioning calculations
- Initial packaging studies
- Concept design sheets
- Component definition
- BOM management
- Supplier management
- Target setting and verification
- Final sign-off
- Product life quality maintenance

**Brake calculations:** Applus IDIADA can work at the very beginning of the development phase, providing support in brake dimensioning and calculations. Caliper piston diameters, disc effective radius, brake pedal ratio, booster ratio and master cylinder dimensions (among other relevant dimensions) can be defined through 1D calculations.

**Performances prediction:** The same in-house developed 1D calculations tool can be used to predict performances at the very beginning of the development stages. Brake

distribution calculation not only guides towards brake effectiveness and pedal feel, but also thermal and legislation prediction.

**Target setting:** Applus IDIADA's Braking Systems department has an extensive background in performance evaluation. This allows us to generate High-Level Targets taking into account strategic product positioning and detailed benchmarking data. A robust target cascading process at Full-Vehicle, System and Component levels can also be deployed in order to support our customers during the full development process.

**Package and 3D integration:** Support can be provided by the Braking Systems Design teams during the packaging and 3D integration phases. A few examples related with this are: axles packaging studies, brake piping routing, pedal box ergonomics definition. Concept 3D design for newly required brake components and carry-over part studies can also be carried out.

**Component definition:** Applus IDIADA can support development with reference information for virtual design while the final component specs are not available. Initial specs setting for expert supplier components (booster, MC, brake discs, ...) can be provided and information can be generated and used as reference for the virtual design process while the final component specifications are not available.

**Technical specs and nomination:** In a full-vehicle development project, expert suppliers play a key role. Applus IDIADA can provide technical specifications generation, supplier nomination support, supplier liaison and management. Technical discussions with suppliers can be managed by Applus IDIADA as well as full component validation support.

**Brake design for soft and hard tooling:** Applus IDIADA can support braking systems and component design. We can release both 2D drawings (for bench test and prototype validation, and for assembly and final production as well) and also 3Ds for prototypes (with DFM approach) and final production. We have experience in GDandT (geometric dimensioning and tolerances) analysis, RMS tolerance stack-up and DFMEA analysis.

**Virtual DVP:** In recent years, virtual validation has increased its relevance within the design and development process. Applus IDIADA has extensive experience in different areas: from strength and durability analysis up to NVH analysis. CFD and thermal analysis can also be carried out (for instance, for brake cooling and brake temperature distribution analysis).

**BOM management:** At the end of the development process, BOM (Bill of Material) can be managed by Applus IDIADA. We have experience in BOM generation, part list maintenance and also in internal processes to manage BOM changes (PDM).

**Post SOP support:** Applus IDIADA has an extensive experience in carrying out series management activities once vehicles are already on the market. Market and fleet complaints, minor changes, cost reductions, face lift derivatives can be managed by Applus IDIADA Braking Systems development team.

Take a look to the following articles, published by the brakes IDIADA team, in [The Break Report Magazine](#):

- [TBR Technical Corner: Optimized Braking System Sizing by means of a Parametric 1D Brake Model \(Part 1 out of 3\)](#)
- [TBR Technical Corner: Optimized Braking System Sizing by means of a Parametric 1D Brake Model \(Part 2 out of 3\)](#)
- [TBR Technical Corner: Optimized Braking System Sizing by means of a Parametric 1D Brake Model \(Part 3 out of 3\)](#)