Dynamic Instability Analysis of Brake Unit

- Overview -

Brake squeal is a dynamic instability phenomenon caused by modal coupling and is a type of self-excited vibration.

It is caused by frictional forces that result in asymmetric contact surface stiffness between the pad and rotor.

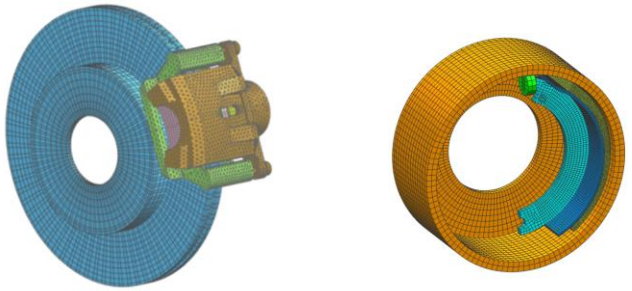
AVES contributes to improving the accuracy of predicting unstable vibrations by determining the contact pressure distribution on the pads and the contact state between components using highly accurate contact analysis.

- Examples of use -

Friction brakes such as disc brakes and drum brakes

Friction clutches

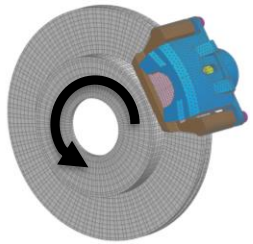
Brakes

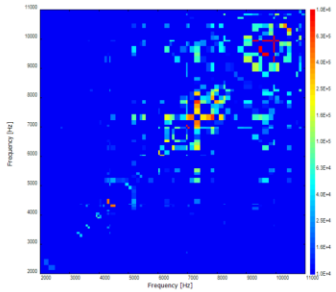


Dynamic Instability Analysis of Brake Unit

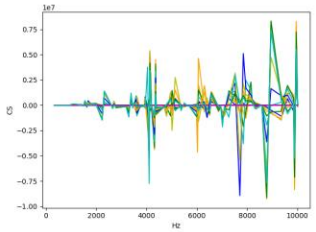
- Stability analysis of brake unit -

- **Coupling strength (CS) evaluation**
  - CS is a stability evaluation index that can be calculated from the real eigenvalues and corresponds to the energy input to the system.
  - Stability is affected by the contact pressure distribution on the pads.



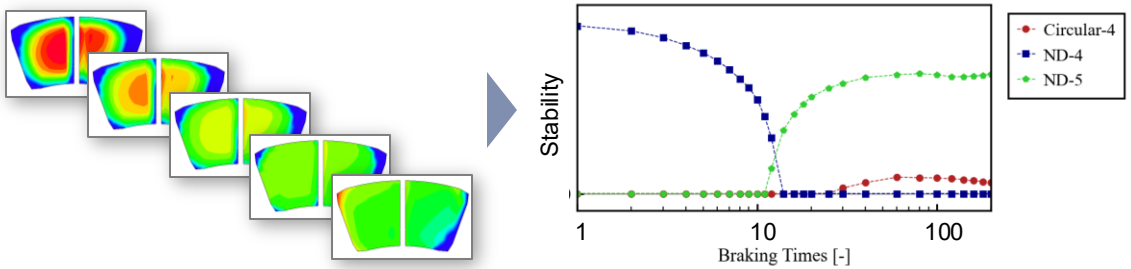


CS matrix



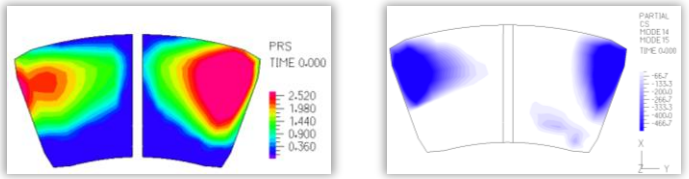
CS vs. frequency

- **Parameterization of contact pressure on pads**
  - The contact pressure distribution on the pad can be treated as a design parameter.
  - It can be applied to optimize chamfering and slit shapes.



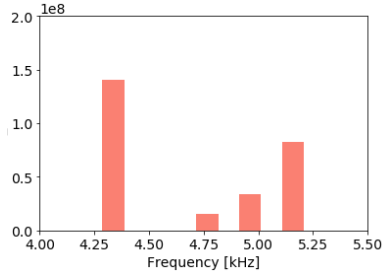
Changes in contact pressure and stability over time

- **Coupling strength (CS) distribution**
  - The area where the energy is input on the friction surface can be visualized.



Contact pressure distribution vs. CS distribution

- **Energy calculations**
  - The dissipated energy and input energy of the brake system can be calculated based on the results of complex eigenvalue analysis.



Energy graph