Fast Simulation of Wear and Contact Pressure During Repeated Braking

- Overview -

Generally, brake wear simulation requires repeated FE analysis, which takes a lot of calculation time.

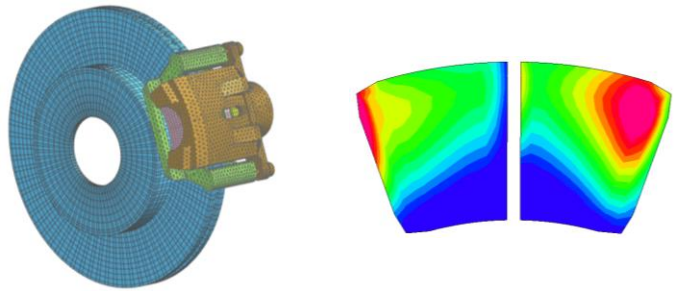
This is because when determining the progression of wear, it is necessary to determine the change in contact pressure distribution that accompanies wear.

Therefore, we developed and implemented a fast simulation method for the time evolution of wear and contact pressure distributions, with minimal use of FE analysis.

- Examples of use -

Friction brakes (disc brakes)

Disk brake



Fast Simulation of Wear and Contact Pressure During Repeated Braking

- Wear caused by repeated braking -

- **Simulation input data**

  Braking time history data

  − Three types of data are required: piston pressure, rotation (vehicle) speed and pad temperature.

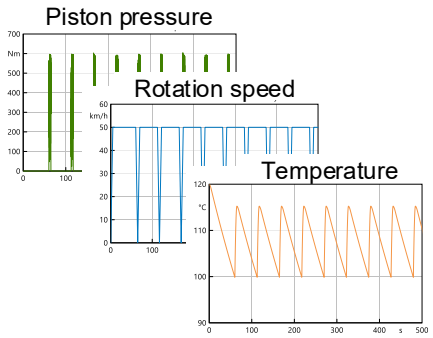
  − These are given as predetermined test conditions, measurement data or calculated data from system simulation.

  Contact pressure distribution on the pads before wear

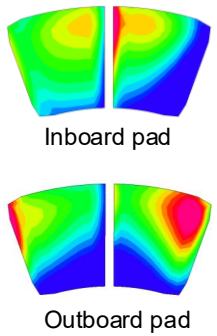
  − The contact pressure distribution before wear (reference contact pressure) must be obtained once in advance using FE analysis.

  Wear rate

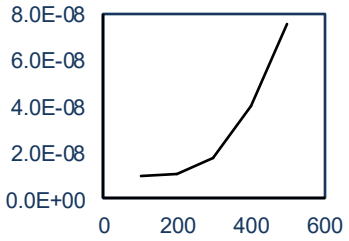
  − It is prepared as a function of temperature, pressure and slip velocity.



Time history data



Reference pressure



Wear rate

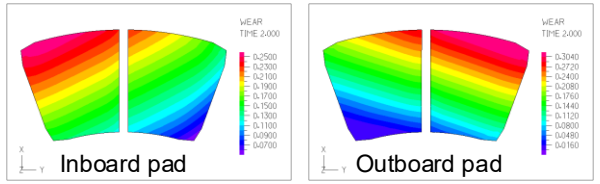
- **Fast simulation**

  − For example, wear caused by repeated braking for 5,000 seconds can be simulated in about 10 minutes.

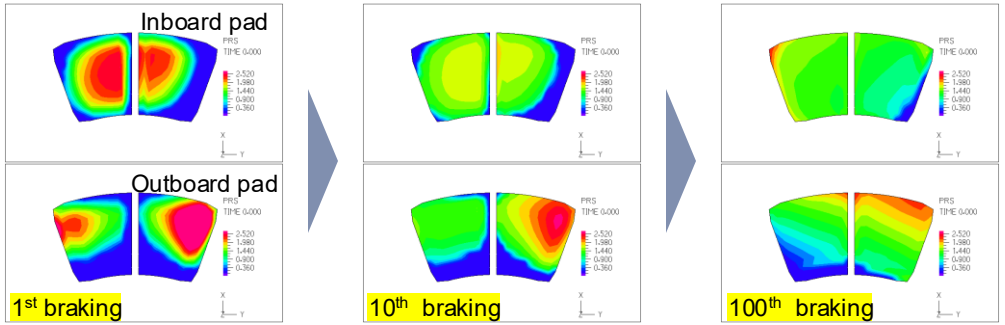
- **Wear and contact pressure distributions**

  − Wear distribution according to the braking history is calculated.

  − Contact pressure changes due to wear. Changes in contact pressure contribute to NV performance such as brake squeal.



Wear distribution after final braking



Contact pressure distributions