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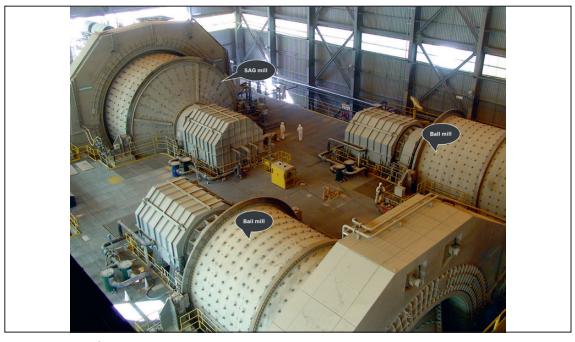
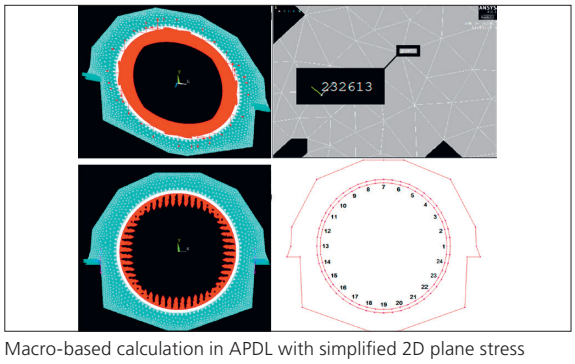
Subject Area	Simulationstechnik
Project Partner	ABB Schweiz AG Minerals & Printing, Dättwil, AG

Vibrations due to harmonics

Structural vibrations in a GMD



Exemplar of a SAG and Ball mills



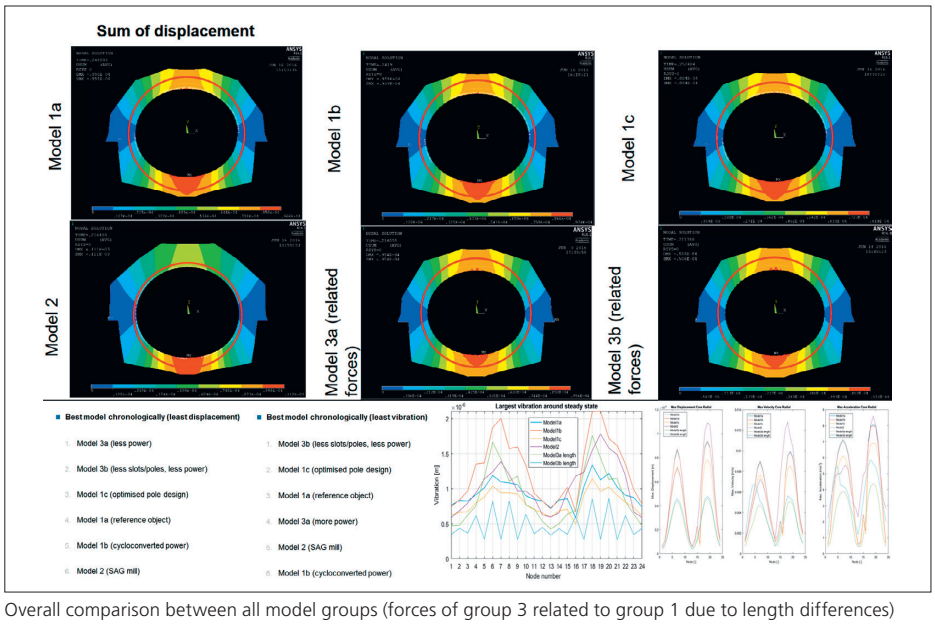
Macro-based calculation in APDL with simplified 2D plane stress transient analysis

Problem: ABB is targeting a new concept of gearless mill drives for grinding applications, by replacing the existing solution of drive with gears. These are available in the power range of 1 MW to 30 MW and with a speed range of 4 min^{-1} to 100 min^{-1}. Content of this thesis is to evaluate different electrical machine performances in terms of their dynamic behaviour in the system, which plays a role in the design of an electrical machine. Especially their behaviour regarding vibrations needs to be investigated.

Proceeding: At first the relevant theory has to be researched. After getting all information, a pilot study can be set up to understand the mechanics. Thereafter, the actual analysis of all models can be made and evaluated.

Result: The source of vibrations has mechanical and magnetic causes. This study mainly showed the influence of supply voltage and slot/pole frequencies to vibrations in a machine. While stimulating the stator with the electromagnetic forces, the following effects could be observed between the comparable groups 1 and 3 (ball mills):

- Model 1a with normal properties has vibrations with average amplitudes
- Model 1b showed the greatest vibrations due to power conversion with cycloconverter
- Model 1c showed better characteristics due to optimised pole design
- Model 2 was not comparable to the groups (different shape of SAG mill), but has average vibrations (greater than 1a)
- Model 3a with higher power and speed showed vibrations with higher amplitudes than 1a
- Model 3b with same power constellation as 3a, but with more poles and less slots, has the lowest vibrations among all models
- Optimisations overall created superposition (additive or subtractive), based on phase delay



Overall comparison between all model groups (forces of group 3 related to group 1 due to length differences)