Paris Session 2022

Preventive Maintenance Technology for Enhancement of Turbine Generator Reliability

SCA1 PS2 / Question 2.6
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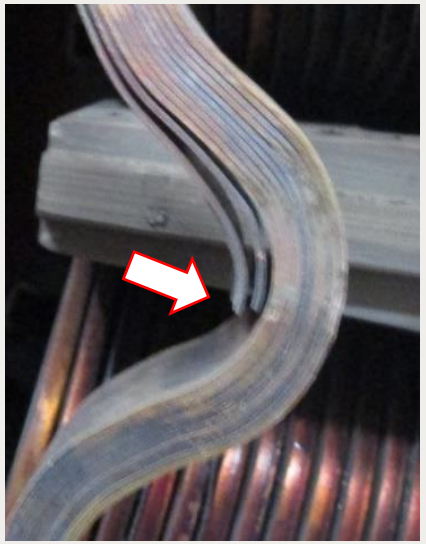
Question 2.6

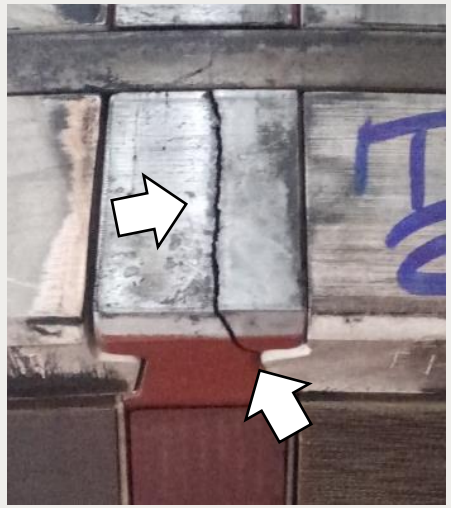
What is the experience of the wider industry and manufacturers with increased start / stop cycling of generators;
are monitoring regimes including areas at increased risk being monitored more frequently, are current standard maintenance regimes considered appropriate?

1. The experience of low cycle fatigue failure

- The risk of low-cycle fatigue failure of rotor components increases due to the increased number of starts / stops (DSS operation).
- We have experienced a breakage of the joint lead between the poles and the rotor teeth under the retaining ring for example.



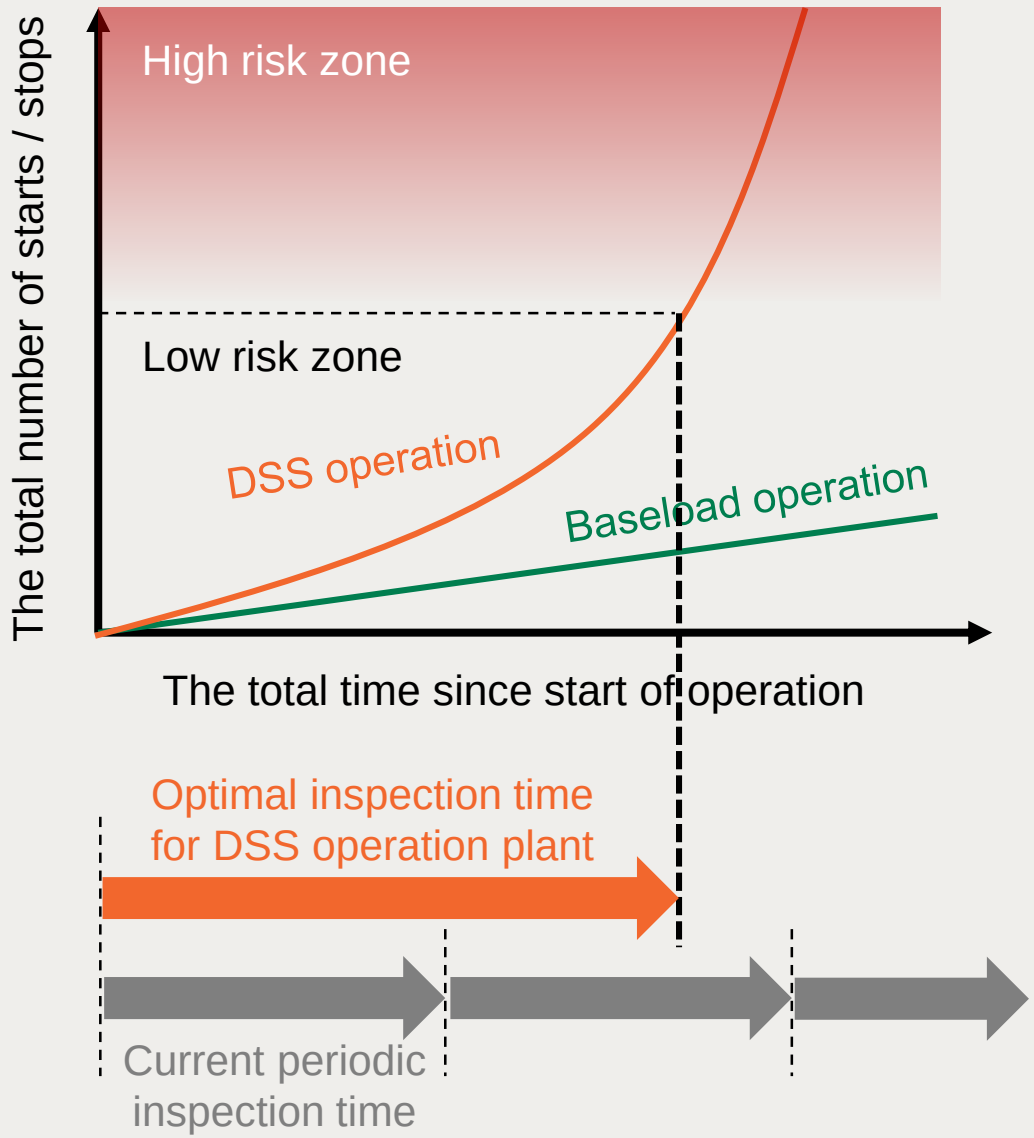
The broken joint lead between the poles



The broken rotor teeth under the retaining ring

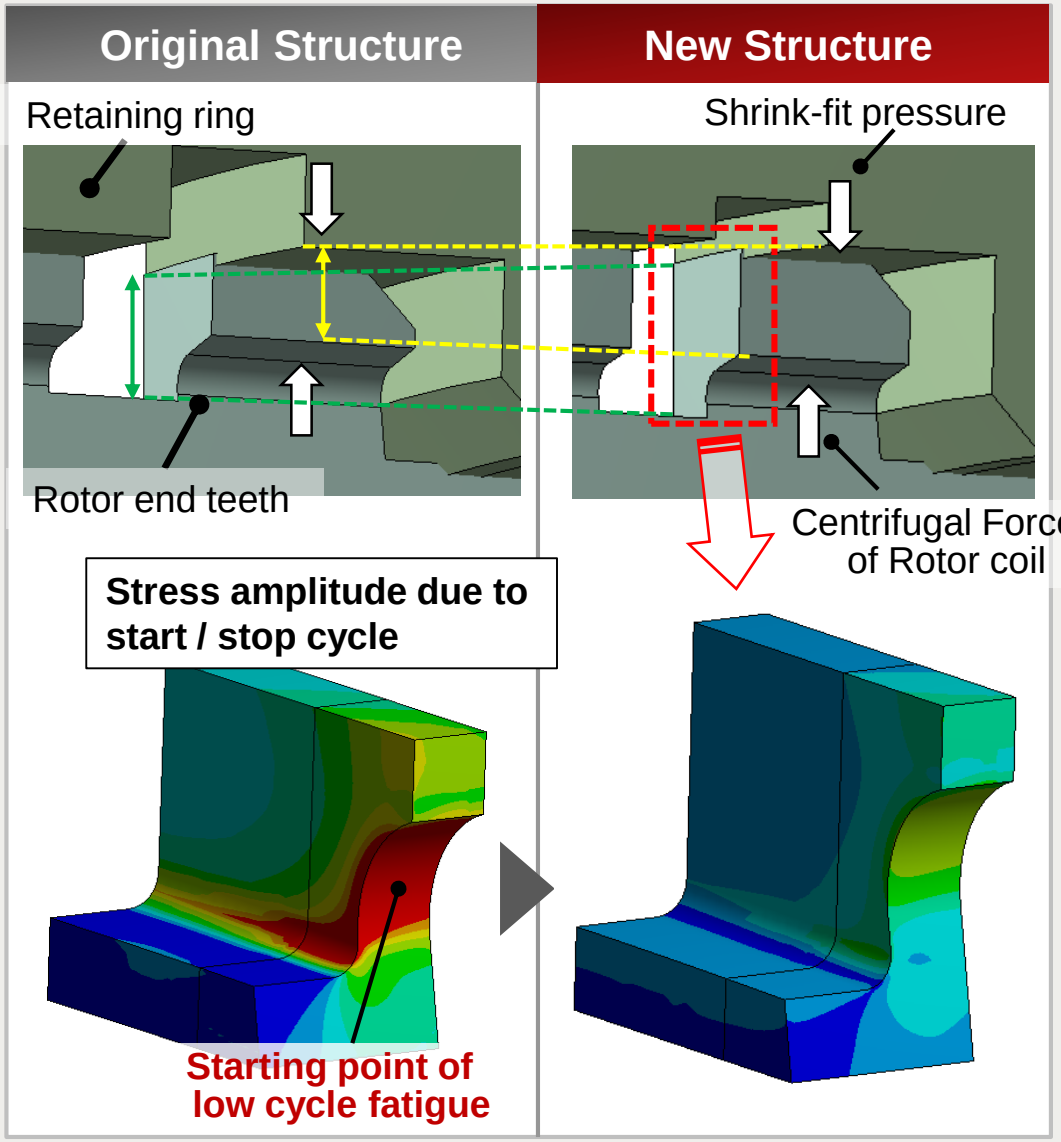
2. Risk management for plant outage

- To reduce the risk of unplanned outage due to rotor component failures, risk management through a combination of accurate lifetime estimation models and appropriate inspection and maintenance will be necessary.
- The lifetime estimation model enables the calculation of probability of failure for an in-service plant based on the actual number of starts / stops, which allows optimal maintenance planning.



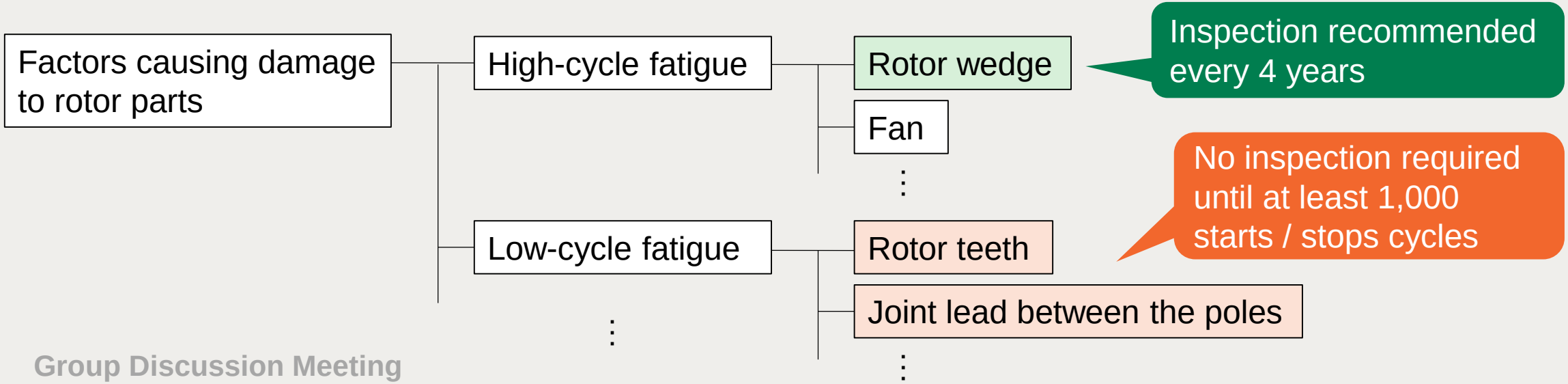
2. Risk management for plant outage

- When the accurate lifetime evaluation model is applied to newly manufactured machines, for example, its design that ensures 99.9% reliability level for 10,000 starts / stops can be achieved, which can reduce the frequency of inspections and thus contribute to improving plant availability.



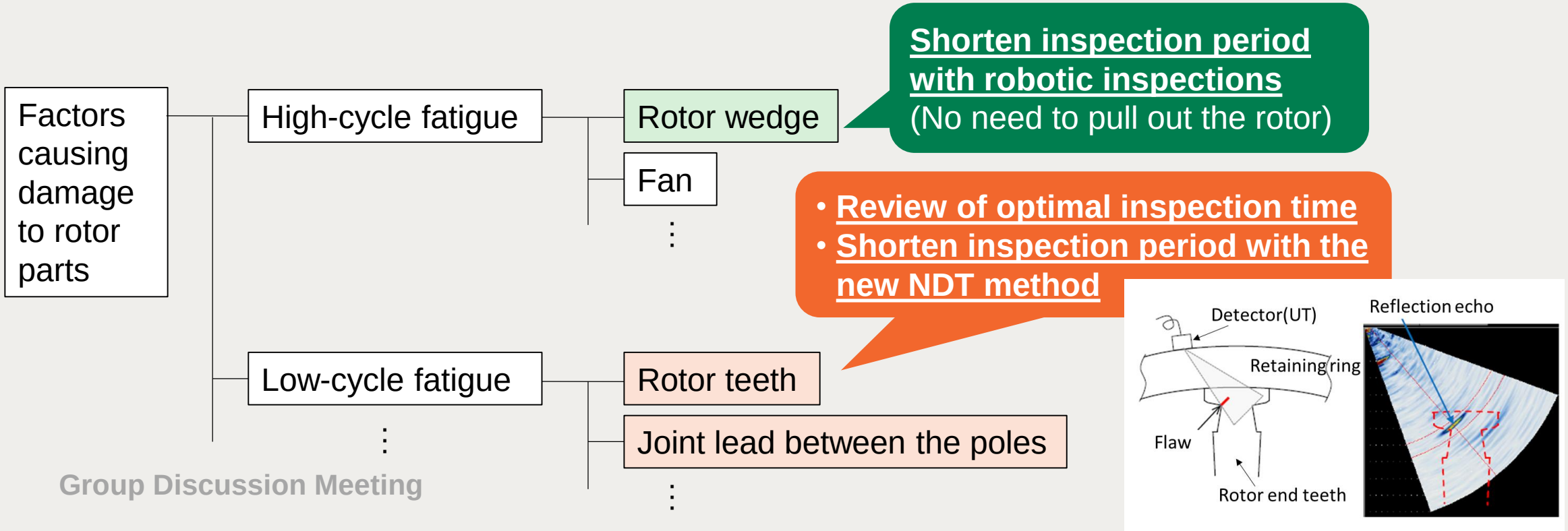
3. Maintenance optimization

- Currently, we recommend that the rotor is pulled out every four years to inspect each component of the rotor. This frequency is determined for preventing accidents due to high-cycle fatigue failure of the rotor wedge.
- We consider that the risk of an unplanned outage due to the low-cycle fatigue failure of rotor components after at least 1,000 starts / stops cycles is quite low as for our products. Therefore, the current four-yearly inspections are assumed to be appropriate for preventing the risk of plant outage.



3. Maintenance optimization

- Conversely, some plants have a low number of starts / stops, and the frequency of inspections could be reduced for the low risk of rotor component damage. We are also working on optimization of our current standard maintenance regimes with the new NDT method and robotic inspections.



4. Conclusion

Due to the change of thermal power plant utilization, the number of start and stop cycles of turbine generator tends to increase, and the risk of low cycle fatigue failure of generator rotor parts becomes higher than that initially envisioned.

Combining the lifetime evaluation technology based on the developed 3D model analysis and the new NDT method, we are working on risk management to reduce the risk of unplanned outage due to rotor component failures and proposing the optimal inspection timing to users.