Paris Session 2022

Transformers mechanical design considering harsh vibratory environment

SC A2 - PS1 - Question 1.1:
What are design challenges for transformers installed in a nacelle with high range of vibration, shock, and special requirements?

Max GILLET - France

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•When implemented inside a nacelle of wind turbine, transformer sees important external vibration levels on long-term due to:

- −Rotor and blades excitation
- −Wind turbine tower and rear frame natural frequencies

- Manufacturers should verify following compliance criteria:
  - −Absence of coincidence between transformer main eigenfrequencies and wind turbine ones
  - −Stress levels < materials' elastic limit
  - −Fatigue damage level < 1 over lifetime

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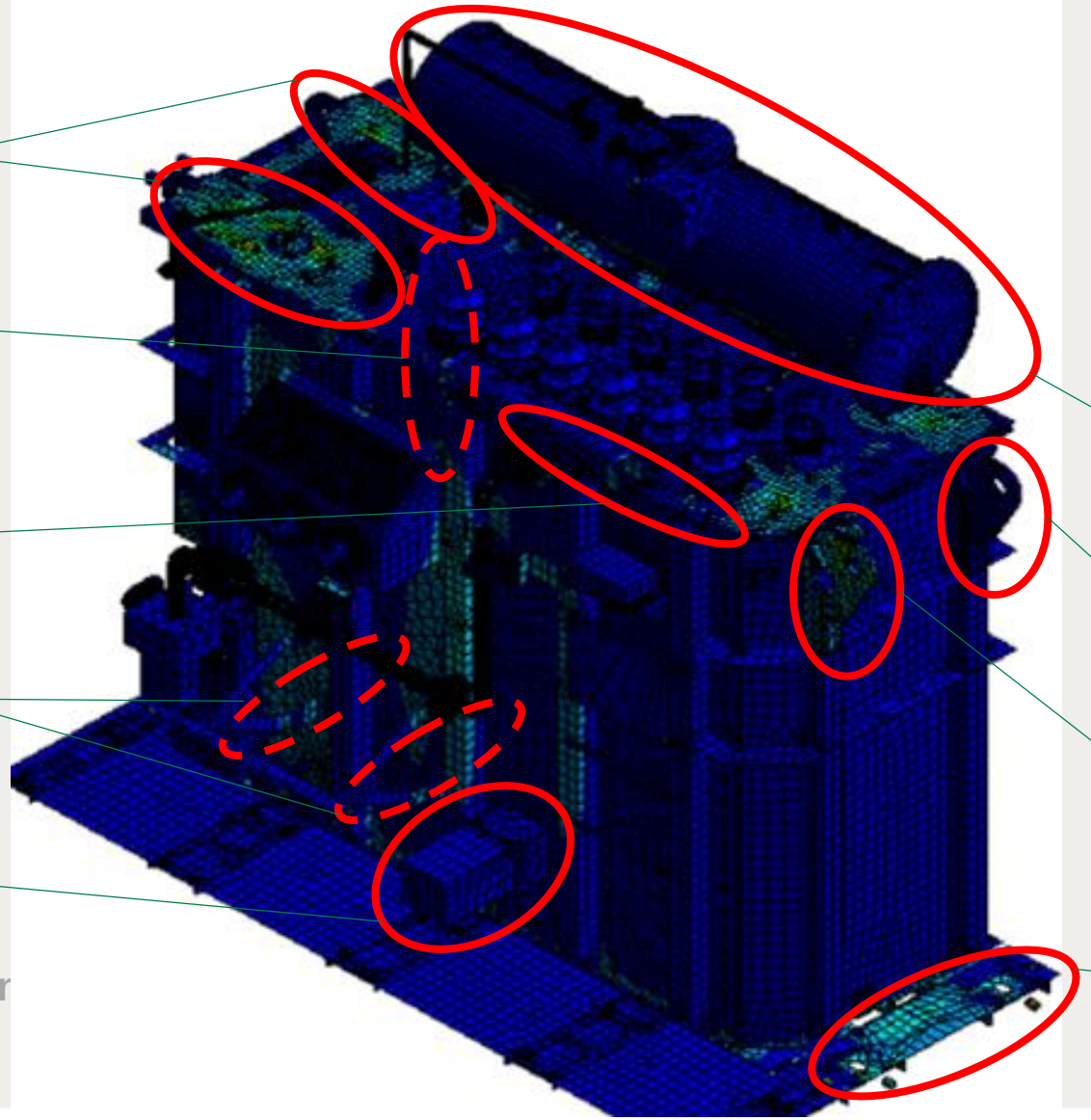
Upper fixations of active part to the tank

Oil pipes

Openings (cover flange, manholes)

Active part feet

Accessories fixed to tank walls



Elements presenting high stress levels due to dynamic excitation

Conservator feet and welds

Lifting lugs, for maintenance operation

Upper fixations to nacelle

Lower fixations to nacelle

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- Long-term dynamic loads implies to study structural fatigue with finite element modelling tools
- Damage estimation including dynamic behaviour can follow these steps:
  - Computation of modal base
  - Determination of stress levels for given power spectral density function
  - Determination of equivalent cumulative damage
  - Post treatment to consider damage levels for each material category
  - Application of hotspot interpolation methodology
- Trial and error process extends mechanical design study duration