

Research on Strength Check Method for Expansive Stressed Grouted Clamp on Complex Joint

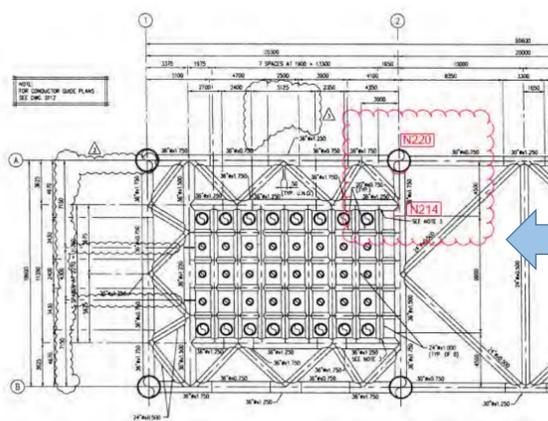
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Abstract

A simplified method of clamp model.
Grout check criteria suitable for complex joints are proposed.
A corresponding expansive stressed grouted clamp was designed.

Background

Damaged joints on offshore platforms.



These two through cracks can increase risk to the structure and affect the platform operation, then expansive stressed grouted clamp is used for reinforcement.

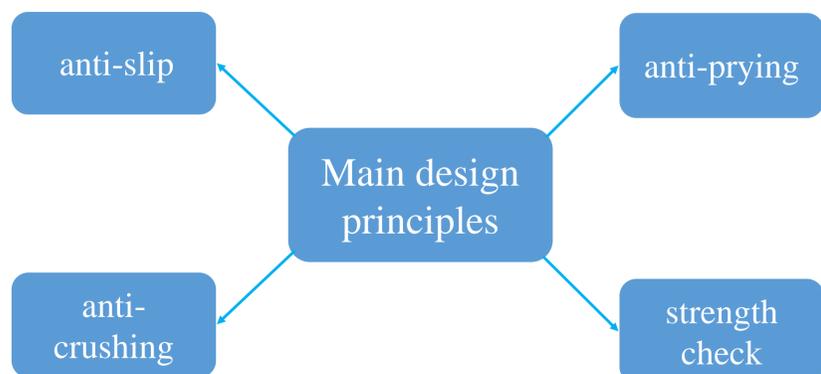
The expansive stressed grouted clamp is designed by the anti-slip check and the anti-prying check to determine the connection size.
The design of the clamp needs to be further checked for strength through finite element analysis.

Problems

the designed clamps can withstand the full load from the original components.

The clamps need to be designed according to the shape of the complex joints. Therefore, the finite element model is very complicated.

Methods



Four parts of the structure verification

The selection of ultimate load cases is carried out according to the principle introduced. The outer end of each joint member is subjected to the corresponding element node force obtained from the SACS platform model.

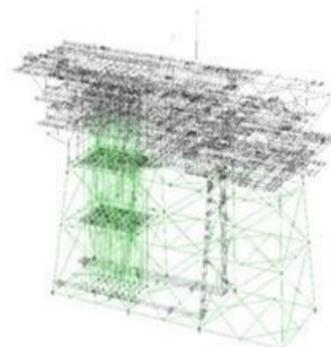
Methods

Simplification method for finite element modeling.

- For steel structures such as pipes and clamp saddles. It is suggested that the shell element is used for their meshing.
- The grout ring is meshed to solid elements with fewer meshes and higher computational accuracy.
- The bolts are modeled using beam element and use MPC constraint equation.

Materials

- The grout of expansive stressed grouted clamps is with 10% FEA expansive agent content, The thickness is set to be 50mm.
- steel structure are all Q345.
- The type of bolt is selected to be M48, its material is 42CrMo.

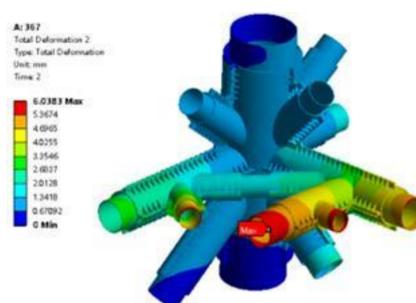


Platform model established by SACS

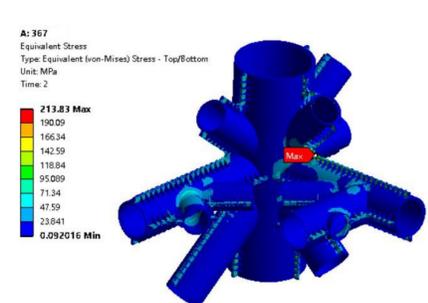


Clamp geometric model by ANSYS

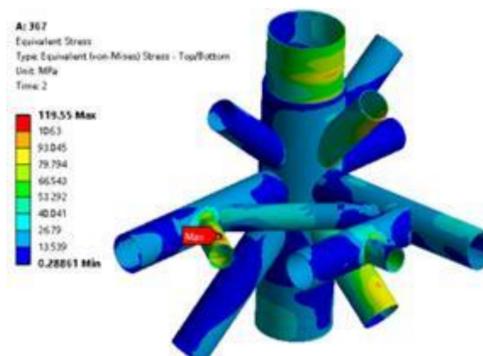
Results



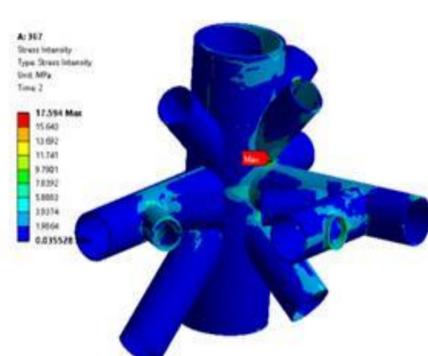
Overall deformation distribution



Equivalent stress distribution of the clamp



Equivalent stress distribution of pipes



Tresca Stress distribution of grout ring

The grout stress solved under the ultimate condition is expressed by Tresca stress, which meet the requirements(DNV for grout connection sections of wind turbine).