

Auskunft:

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UNIVERSITÄT SIEGEN • Department Maschinenbau • 57068 Siegen

## B.Sc.-Arbeit (MB/WIW)

Siegen, 6. April 2022

### Titel: Numerische Untersuchung von Groutverbindungen und Validierung mit experimentell ermittelten Messergebnissen

Offshore wind turbines are often founded using a monopile construction. Here the transition piece or the tower of the wind turbine is connected via a so-called grout connection to the monopile, which is driven into the seabed. The monitoring of the grout connection based on vibrational analysis is the subject of the research project "In-Situ-WIND".

As part of the project, a measurement system and sensors have already been installed to an offshore wind turbine in the North Sea. Strain gages were applied at two levels: above the grout connection at the transition piece and at the level of the grout connection at the monopile. The aim is to be able to calculate loads, monitor stresses and detect possible damage. Since the mechanism of load transfer from the transition piece to the monopile via the grout connection is difficult to describe, a simplified FE-model is to be built in order to better understand the basic mechanisms.

Therefore, the study work includes the following steps:

1. Literature research regarding grout connections and their numerical simulation
2. FE-Simulation
  - 2.1. Preprocessing: Build a model of a grout connection
  - 2.2. Solver
  - 2.3. Postprocessing: Evaluate the results
3. Validation and interpretation of the results
  - 3.1. Validation
  - 3.2. Describe the relationships between the calculated stress components
  - 3.3. Make recommendations for positioning of strain gauges and evaluation methods
4. Detailed documentation and presentation

The work can be done in German or English. Please note the special conditions of our working group MSHM and the respective examination office.

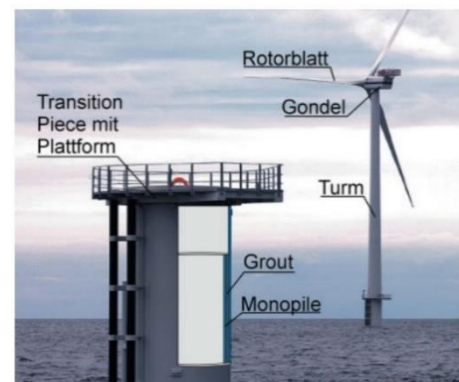


Figure 1: Grouted joint of an offshore wind turbine [Schaumann 2008]

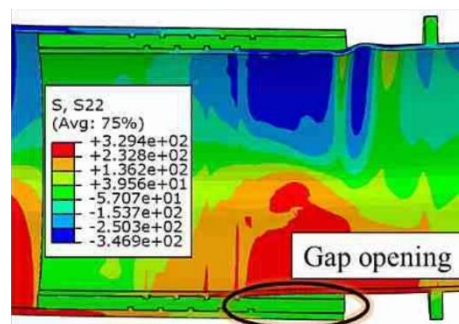


Figure 2: FE-Simulation of a grout connection of a large-scale test rig [Tziavos 2019]

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## Studienarbeit (Mechatronics)

Siegen, 6. April 2022

### Title: Numerical investigation of the stress behavior of grouted joints from offshore wind turbines

Offshore wind turbines are often founded using a monopile construction. Here the transition piece or the tower of the wind turbine is connected via a so-called grout connection to the monopile, which is driven into the seabed. The monitoring of the grout connection based on vibrational analysis is the subject of the research project "In-Situ-WIND".

As part of the project, a measurement system and sensors have already been installed to an offshore wind turbine in the North Sea. Strain gages were applied at two levels: above the grout connection at the transition piece and at the level of the grout connection at the monopile. The aim is to be able to calculate loads, monitor stresses and detect possible damage. Since the mechanism of load transfer from the transition piece to the monopile via the grout connection is difficult to describe, a simplified FE-model is to be built in order to better understand the basic mechanisms.

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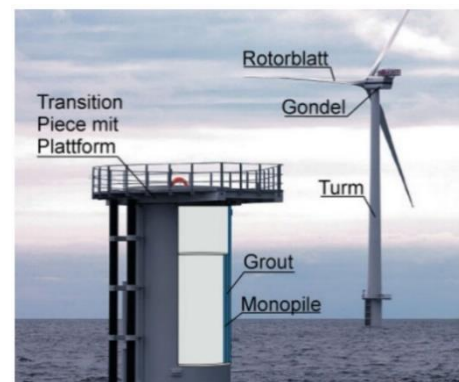


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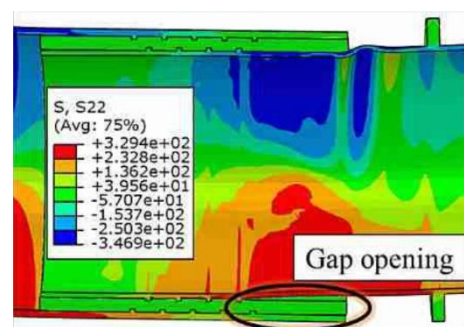


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## M.Sc.-Arbeit (MB/WIW/Mechatronics)

Siegen, 6. April 2022

### Titel: Modellierung und Methodenentwicklung zur Schadensüberwachung von Groutverbindungen (engl.: Modeling and method development for structural health monitoring of grouted joints)

Offshore wind turbines are often founded using a monopile construction. Here the transition piece or the tower of the wind turbine is connected via a so-called grout connection to the monopile, which is driven into the seabed. The monitoring of the grout connection based on vibrational analysis is the subject of the research project "In-Situ-WIND".

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3. Validation and interpretation of the results
  - 3.1. Validation
  - 3.2. Describe the relationships between the calculated stress components
  - 3.3. Make recommendations for positioning of strain gauges and evaluation methods
4. Verification and model fitting with real measurements
5. Model reduction and method development for structural health monitoring
6. Detailed documentation and presentation

The work can be done in German or English. Please note the special conditions of our working group MSHM and the respective examination office.

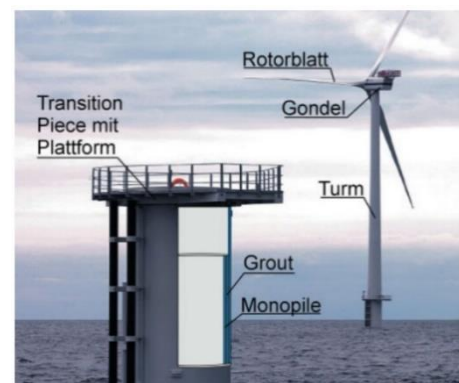


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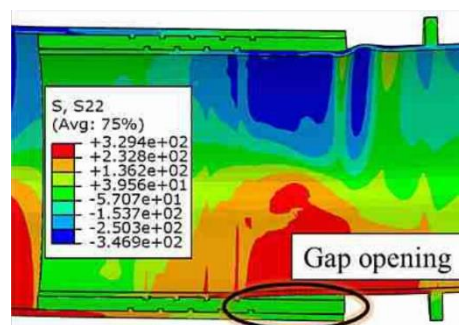


Figure 2: FE-Simulation of a grout connection of a large-scale test rig [Tziavos 2019]