Bachelor Thesis: Investigation of Motion Control Systems and Their Integration into Floating Offshore Structures

Research question: How can motion control systems be effectively integrated into floating offshore structures, and which floater designs provide the best technical and commercial fit for their implementation?

Background

Hoppe Marine offers advanced anti-rolling and anti-heeling solutions for marine and offshore applications. A previous study conducted by Hoppe investigated the effects of dynamic and static motion control on floating offshore wind platforms and indicated that power production could be increased by up to 3% annually through improved platform stability.

Building on these findings, the next step is to assess how Hoppe's motion control technologies can be integrated into different floating offshore structures. This includes a comprehensive review of existing floater concepts, competing technologies, and relevant patents. Various integration concepts for anti-rolling, anti-heeling, and combined systems will be developed and evaluated.

In addition to the technical assessment, the commercial viability of each concept must be considered. Cost estimates will be developed for different system configurations to evaluate the return on investment (ROI) and identify solutions that provide the best balance between technical performance and economic feasibility.

The thesis will ultimately identify the most promising floater-motion-control combinations and provide recommendations for future product development and market opportunities in the floating offshore wind sector.

Objectives

The objectives of this thesis are to:

1. Review existing motion control technologies applicable to floating offshore structures.
2. Analyze patents and competing solutions related to anti-rolling and anti-heeling systems.
3. Assess the suitability of different floating offshore structure designs for motion control system integration.
4. Develop integration concepts for anti-rolling, anti-heeling, and combined solutions.
5. Estimate implementation costs for each integration concept.
6. Evaluate the technical benefits and economic potential of each concept.
7. Identify the optimum balance between performance, integration complexity, and commercial attractiveness.
8. Provide recommendations for the most promising applications of Hoppe's technology in floating offshore wind.

Methodology

1. Literature and Patent Review
    a) Review existing motion control technologies for floating structures.
    b) Analyze relevant patents, intellectual property, and competing solutions.
    c) Review currently deployed and emerging floating offshore wind platform designs.
    d) Investigate other floating offshore assets and structures that could benefit from motion control systems.

2. Development of Technical Integration Concepts
    a) Develop anti-rolling integration concepts for different floater types.
    b) Develop anti-heeling integration concepts for different floater types.

c) Develop combined anti-rolling and anti-heeling concepts.
d) Assess installation requirements, space constraints, and system interfaces.

3. Development of Cost Estimation Models
   a) Create a cost estimation framework for anti-rolling systems.
   b) Create a cost estimation framework for anti-heeling systems.
   c) Create a cost estimation framework for combined systems.
   d) Estimate CAPEX, installation costs, and operational considerations.

4. Technical and Commercial Assessment
   a) Evaluate technical effectiveness of each concept.
   b) Estimate performance improvements and operational benefits.
   c) Assess economic impact and return on investment.
   d) Identify the optimal trade-off between technical performance and cost.
   e) Rank concepts according to overall attractiveness.

5. Results and Recommendations
   a) Document methodology, assumptions, and results.
   b) Compare different integration concepts.
   c) Identify the best technical solution.
   d) Identify the best commercial solution.
   e) Recommend the most attractive "sweet spot" between technical benefit and economic value.
   f) Provide recommendations for future development and commercialization.

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