

論文 / 著書情報
Article / Book Information

題目(和文)	
Title(English)	Investigation of Utilising Coriolis Effect for Attenuating Long-Period Vibration of Tall Flexible and Rolling Structures
著者(和文)	WALKERMarioPatrick
Author(English)	Mario Walker
出典(和文)	学位:博士(学術), 学位授与機関:東京工業大学, 報告番号:甲第10888号, 授与年月日:2018年3月26日, 学位の種別:課程博士, 審査員:大熊 政明,坂本 啓,鈴森 康一,高原 弘樹,山浦 弘
Citation(English)	Degree:Doctor (Academic), Conferring organization: Tokyo Institute of Technology, Report number:甲第10888号, Conferred date:2018/3/26, Degree Type:Course doctor, Examiner:,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

(博士課程)
Doctoral Program

論文要旨

THESIS SUMMARY

専攻 :
Department of Mechanical and Aerospace Engineering
学生氏名 :
Student's Name Mario Patrick Walker

専攻

申請学位 (専攻分野) : 博士 ()
Academic Degree Requested Doctor of (Philosophy)

指導教員 (主) :
Academic Supervisor(main) Masaaki Okuma

指導教員 (副) :
Academic Supervisor(sub) Hiraku Sakamoto

要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

The purpose of this graduation thesis, Investigation of Utilising Coriolis Effect for Attenuating Long-period Vibration of Tall Flexible and Rolling Structures, is to analyse the use of Coriolis effect in reducing the response of long-period tall flexible and rolling structures. Vibration control can be achieved through several methods of which a common approach is to use counteractive motion conventionally in the lateral direction. However, space in this direction can be quite limited. For this reason the author proposes using motion in the longitudinal/radial direction to generate counteractive moments. This thesis first examines the attenuation of tall flexible structures through cyclic motion of a moving mass in the longitudinal direction, and present the results. For the second investigation, the concept is applied to rolling structures this time using unidirectional water-flow in the radial direction. Finally, based on the first investigation proposal for an improved system is done using a multi-degree-of-freedom system controlled by Fuzzy logics. The results of the investigations show that the proposed concept can be used to effectively reduce the response of these structures, however there are concerns about implementation of the concept in practical situations. The author recommends further modification and investigation are needed for the proposed concept, for it to be considered a viable alternative for conventional methods.

The graduation thesis is organised in eight chapters.

Chapter 1 gives an introduction to the problem and describes the background and motivation behind the research. The objectives and scope of the research are also presented.

Chapter 2 presents a review of the literature that contributed to the research. Review of the state-of-the-art currently in the field of structural control and stabilising systems in marine engineering are presented and discussion of the theoretical approaches undertaken in the study are done. Finally, a description of how the research attempts to address the issue is given.

Chapter 3 presents the design of the research. An outline of the procedure taken to get the results and how these results are analysed in order to achieve the goals of the research are given.

Chapter 4 examines the attenuation of tall flexible structures using moving mass in the longitudinal direction. The analysis is done using the moving finite element method (MFEM). Details of the formulation of the MFEM model in order to analyse the dynamic response specifically for the case of a flexible beam structure is given. The performance of the proposed concept is analysed using the Shinjuku Mitsui Building as the benchmark model. Critical parameters are identified and based on the results proposal for further investigations are made.

Inspired by proposal made in the previous chapter, Chapter 5 proposes and investigates a method to reduce the rolling of ships by inducing Coriolis effect using water-flow in the radial direction of the vessel. Performance and robustness of such a system is studied using a Ro-ro vessel as the benchmark model. Numerical and analytical investigations are conducted. A comparison of performance of the proposed concept with the analytical results and without the stabilising system is done.

Also inspired by proposal made in Chapter 4, a multi-degree-of-freedom hybrid enhanced effect damper is proposed and investigated in Chapter 6. A benchmark super tall structure based on a proposed structure for Melbourne is investigated. The system is studied under seismic excitations based on recordings from the Loma Prieta earthquake in California in 1989. Additionally, the system is studied under free response. Control algorithm based on Fuzzy logic is designed for the hybrid enhanced effect damping system. Stability of the fuzzy logic controllers are verified using Lyapunov's direct method and phase plane method. The performance of the proposed system is investigated. Finally, comparison of the results from the investigation is done for system without control, with an optimal tuned mass damper (TMD) based on Hartog's method, a Fuzzy logic controlled active tuned mass damper and the proposed hybrid enhanced effect damper.

The final chapter highlights conclusions drawn from the research. Furthermore, recommendations and further extension of the research are given.

備考 : 論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).

注意 : 論文要旨は、東工大リサーチリポジトリ(T2R2)にてインターネット公表されますので、公表可能な範囲の内容で作成してください。

Attention: Thesis Summary will be published on Tokyo Tech Research Repository Website (T2R2).