Spacecraft Propullsion System Engineering

Special Subjects
Elective 2 credit

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1. Course Description

This course provides fundermental topics and advanced topics of space system engineering including orbit and trajectory mechanics and propullsion systems. Students can comprehend applications of space systems if they will attend this class after learning the "Introduction to Space Engineering" at a second-year undergraduate and the "Space System Engineering" at a third-year undertraduate. This subject is related to the clause 1 and 2 of the diploma policy of the Department of Aerospace Engineering. This course consists lecture and interactive discussion which related to lecture topics.

2. Course Objectives

- Overview, Fundermentals and Advanced knowledge of space environment
- Analysis and discussion for future space utilization
- Design of spacecraft system (satellites, interplanetary probes)
- Advanced topics of orbital dynamics (unique orbits, perturbation)
- Specific design flow of space mission and spacecraft including propullsion systems

3. Grading Policy

- Attendance: more than 2/3 (Requirements to take End-term exam.)
- Homework: 40%
- End-term Report: 60%

Detail solutions of homework will be shown in LMS and be given feedback at lecture.

4. Textbook and Reference

Textbook
Lecture materials will be provided from LMS. (If needed, printed materials will be distributed at lecture).
Reference
小泉 宏之 『宇宙はどこまで行けるか-ロケットエンジンの実力と未来』 中公新書、2018、ISBN-13: 978-4121025074
岩崎信夫、的川泰宣著、宇宙航空研究開発機構監修 『図説 宇宙工学』 日経印刷、2010、ISBN-13: 978-4904260715
James Richard Wertz 『Space Mission Engineering: The New Smad』 Microcosm Press、2011、ISBN-13: 978-1881883159

5. Requirements(Assignments)

Pre-condition: Students must understand the fundamental topics of space engineering though the previous lecture "Introduction to Space Engineering" at a second-year undergraduate.
Preparation (1.5 hours): Students must read through the lecture materials and check in advance for any questions summarize them in a notebook.
Review (1.5 hours): Student must recheck the lecture materials, make reports or homework for better understanding

6. Note

- Students will give presentations on homework assignments in the classes.
- Lecture contents may change depending on progress.
- Necessary items to bring to lecture: function calculator or note PC, tablet PC, smartphone.
- Recommended items to bring to lecture: Devices to access Internet (like note PC, tablet PC, and smartphone, etc.)

7. Schedule

[1]	Introduction, Review of “Introduction of Space Engineering”
[2]	Backgound and Classification of Use Case of Spacecraft Propullsion System
[3]	Spacecraft Orbit and Trajectry Design, Understanding of Propullsion System(1): Newtonean Mechanics and Fundamentals of Orbital Dynamics
[4]	Spacecraft Orbit and Trajectry Design, Understanding of Propullsion System(2): Fundamentals of Rocket Engineering
[5]	Spacecraft Orbit and Trajectry Design, Undserstanding of Propullsion System(3): Fundamentals of Near Earth Orbit
[6]	Spacecraft Orbit and Trajectry Design, Understanding of Propullsion System(4): Advanced Topics of Near Earth Orbit
[7]	Spacecraft Orbit and Trajectry Design, Understanding of Propullsion System(5): Fundamentals and Applicaitons of Deepspace Trajectories for Planetary Expolaration
[8]	Mid-term Summary, Group Disussion
[9]	Examples of Spacecraft Propullsion System(1): Backgraound and History of Chemical Propullsions on Near Earth Orbit
[10]	Examples of Spacecraft Propullsion System(2): Applications and State-of-the-art of Chemical Propullsions
[11]	Examples of Spacecraft Propullsion System(3): Backgraound and History of Electriical Propullsions on Near Earth Orbit
[12]	Examples of Spacecraft Propullsion System(4): Applications and State-of-the-art of Electrical Propullsions

[13] Examples of Spacecraft Propullsion System(5): Special Case of Spacecraft Propullsion Systems
[14] Discussions for Future Missions and Case Study
[15] Summary, Guidance of End-Term Report