Budapest University of Technology and Economics
Faculty of Mechanical Engineering
Department of Fluid Mechanics
http://www.ara.bme.hu/

FINAL PROJECT ASSIGNMENT

Publicly Available

Identification

Name: **Hafner Zoltán**			ID: **77190130467**
Code of the Curriculum: 2N-MW0		Specialisation: 2N-MW0-FM	Document ref. number: GEÁT:2024-1:2N-MW0:JE8E3T
Curriculum: Master Program in Mechanical Engineering Modelling			
Final Project issued by: Department of Fluid Mechanics		Final exam organised by: Department of Fluid Mechanics	
Supervisor: Dr. Farkas Balázs (71421842963), assistant professor			

Project Description

Title	**Investigation of Aerodynamics Forces in Suborbital Rocket and Applied Air Brake Systems Using CFD Simulations** Szuborbitális rakétarendszereken és az azokon alkalmazott féklapokon ébredő aerodinamikai erők vizsgálata CFD szimulációk alkalmazásával
Details	1. Identify and comprehend the aerodynamic forces exerted on rockets. 2. Investigate the stages of high-power rocket flight and types of control surfaces utilized. 3. Determine the stability parameters critical for ensuring safe rocket flight. 4. Explore the challenges associated with CFD calculations concerning air brakes. 5. Develop a detailed 3D model of the rocket system without air brakes. 6. Create a numerical mesh with appropriate resolution for preliminary CFD simulations. 7. Define boundary conditions guided by preliminary calculations and literature research. 8. Validate preliminary CFD results by assessing their mesh independence. 9. Compare preliminary CFD results with recent studies to ensure accuracy. 10. Validate the stability parameters using numerical findings. 11. Determine effective positioning and dimensions of air brakes based on preliminary CFD outcomes. 12. Identify suitable methods for integrating air brakes into the rocket system. 13. Update the 3D rocket model to incorporate air brakes and control surfaces. 14. Revise mesh and simulation parameters for detailed air brake analysis. 15. Consider the impacts of air brake deployment on rocket stability and aerodynamics. 16. Compare advanced CFD outcomes with recent research for consistency. 17. Determine parameters that contribute to enhanced aerodynamic efficiency and stability. 18. Summarize the research, methodology, findings, and conclusions. 19. Organize the thesis following the prescribed format for an MSc Thesis document.
Advisor	Advisor's Affiliation: Advisor: --

Final Exam

1st subject (group)	2nd subject (group)	3rd subject (group)	4th subject (group)
ZVEGEÁTNW02 Computational Fluid Dynamics	**ZVEGEÁTNW03** Fluid Mechanics Measurements	**ZVEGEÁTNW11** Open Source Computational Fluid Dynamics	**ZVEGEÁTNW19** Vehicle Aerodynamics

Authentication

Handed out: 4 September 2023		Deadline: 8 December 2023
Compiled by: Dr. Farkas Balázs (71421842963) Supervisor	Verified by: *Dr. János Vad* (signed) Head of Department	Approved by: *Dr. Gábor Györke* (signed) Vice-Dean

The undersigned declares that all prerequisites of the Final Project have been fully accomplished. Otherwise, the present assignment for the Final Project is to be considered invalid.

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Hafner Zoltán