

1 Introduction

1.1 The problem of aerodynamic drag

Dlaczego badamy oraz wzór na opór aerodynamiczny. Że bazujemy na modern exterior ballistics i jakieś inne z literatury bo to ładnie brzmi.

1.2 Methodology of the present work

For simulations, two programs were chosen to compare the results. The first program, Solidworks Flow Simulation, was used for both CFDs and model preparation. The second program utilized was Ansys Fluent.

Initially, the models were prepared in Solidworks and subsequently exported to .step (214) file format for importation into Ansys. Within Ansys, Fluent with Meshing was used to prepare the mesh, followed by the execution of simulations. Solidworks Flow Simulation was also employed for mesh preparation and simulation execution, enabling subsequent comparison with results obtained from Ansys Fluent.

Parametric studies/sets were conducted for all models, encompassing nine different velocities ranging from 0.1 to 1.0. Subsequently, resulting graphs depicting the drag coefficient versus Mach number were analyzed and compared.

1.3 Tested models

R6-Endcone, R6-No-Endcone, PrawieR5

For each set of simulations, computational domain mesh setting and graph of velocity and pressure for 0.6 mach will be shown.

2 Initial study

ChatGPT

The work was initiated with the remodeled R5 model, which had been prepared in Solidworks and featured an endcone, a modification in comparison to the original R5 model. Subsequent testing of the model was conducted using Solidworks Flow Simulation. However, this model was solely utilized for comparing the results of the older model with the new one. The results can be observed here

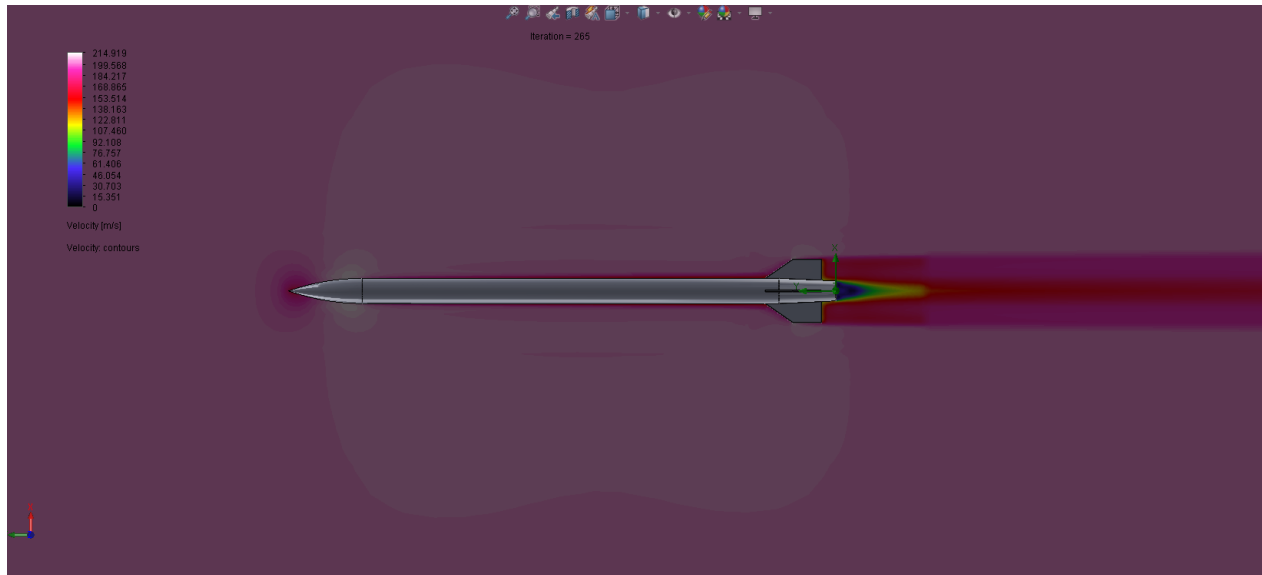


Figure 1: Velocity graph for PrawieR5 model at Mach 0.6

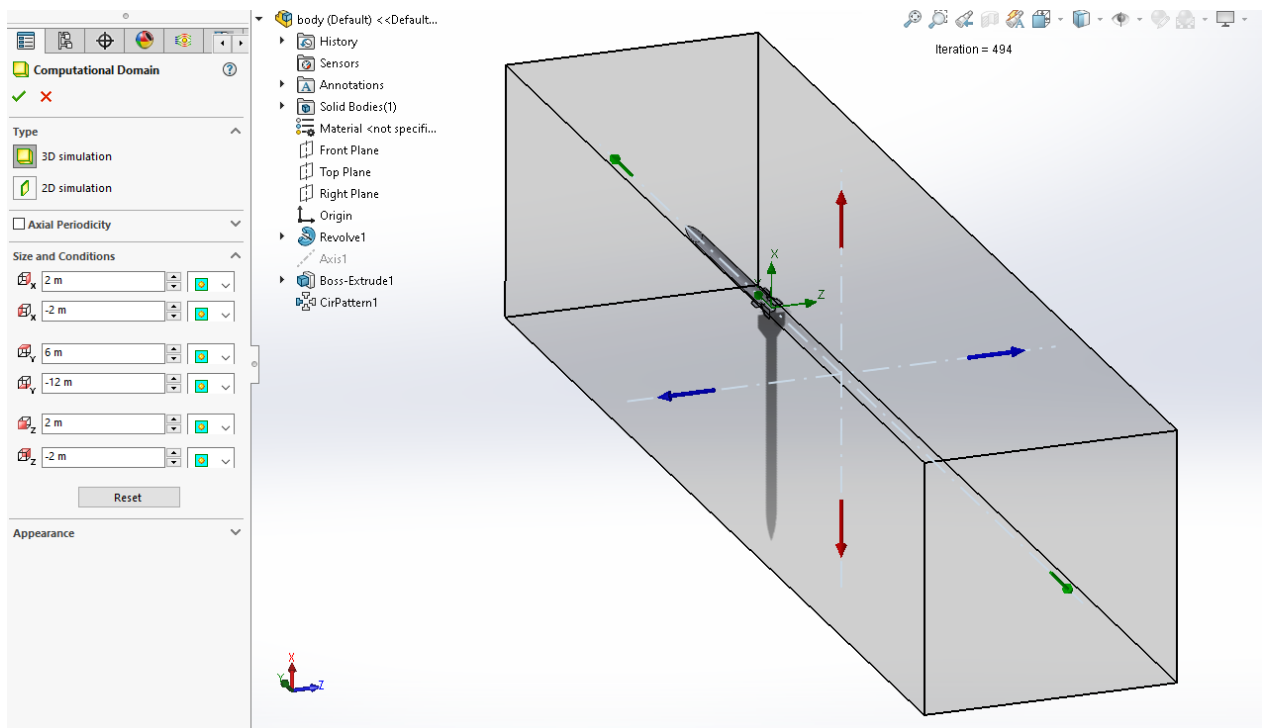


Figure 2: CD graph for PrawieR5 model at Mach 0.6

3 R6 Endcone

3.1 Solidworks

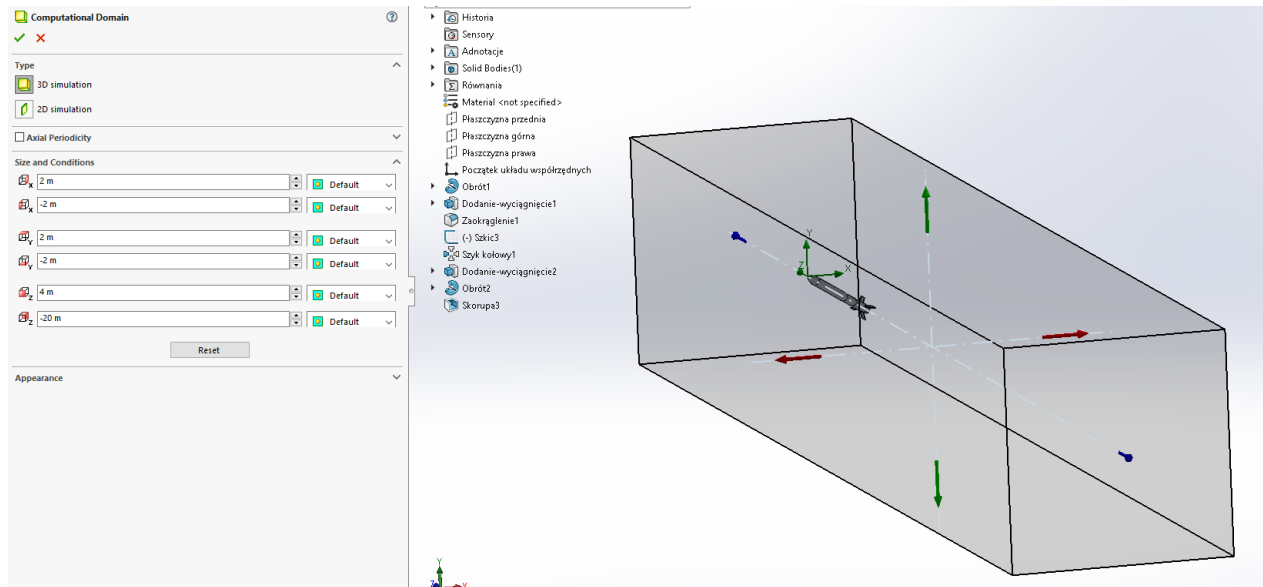


Figure 3: Computational domain for R6-Endcone model

Total cells	351,913
Fluid cells	351,913
Fluid cells contacting solids	51,217

Figure 4: Cell number for R6-Endcone model

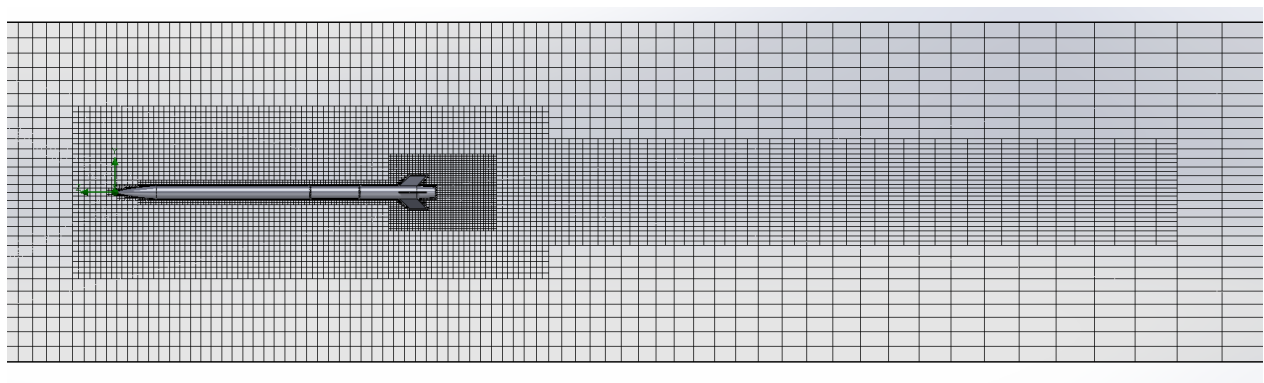


Figure 5: Mesh for R6-Endcone model

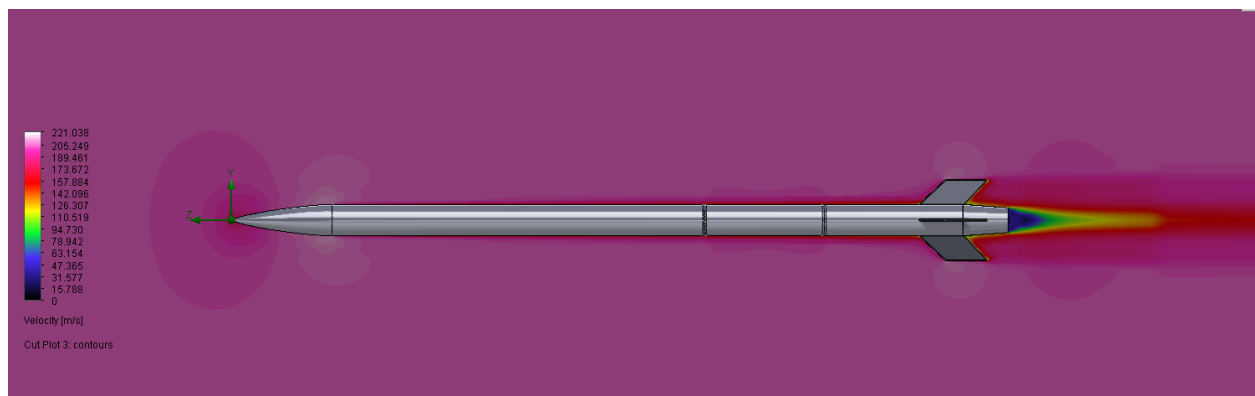


Figure 6: Velocity graph at 0.6 Mach for R6-Endcone model

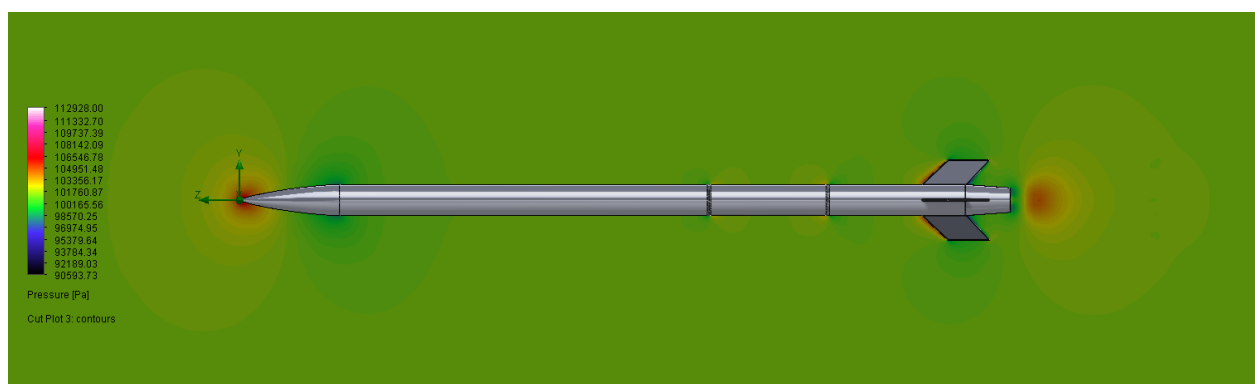


Figure 7: Pressure graph at 0.6 Mach for R6-Endcone model

3.2 Ansys Fluent with meshing

- Domena i mesh
- Kolorki dla 0.2, 0.5, 0.8

Wykresy obu na koniec zestawić.

4 R6 No Endcone

4.1 Solidworks

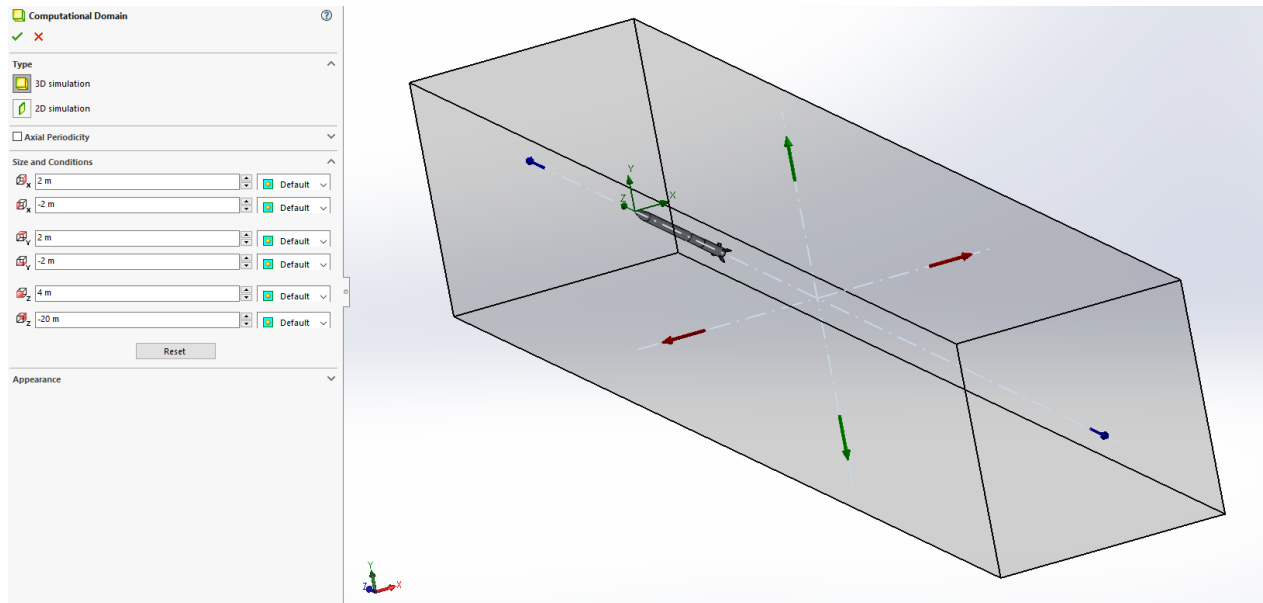


Figure 8: Computational domain for R6-NoEndcone model

Total cells	475,197
Fluid cells	475,197
Fluid cells contacting solids	74,456

Figure 9: Cell number for R6-NoEndcone model

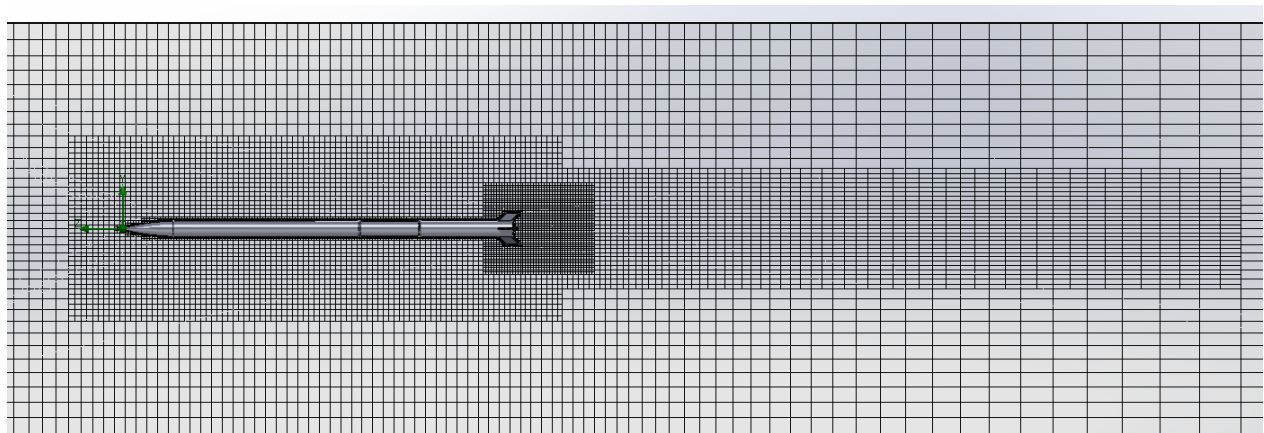


Figure 10: Mesh for R6-NoEndcone model

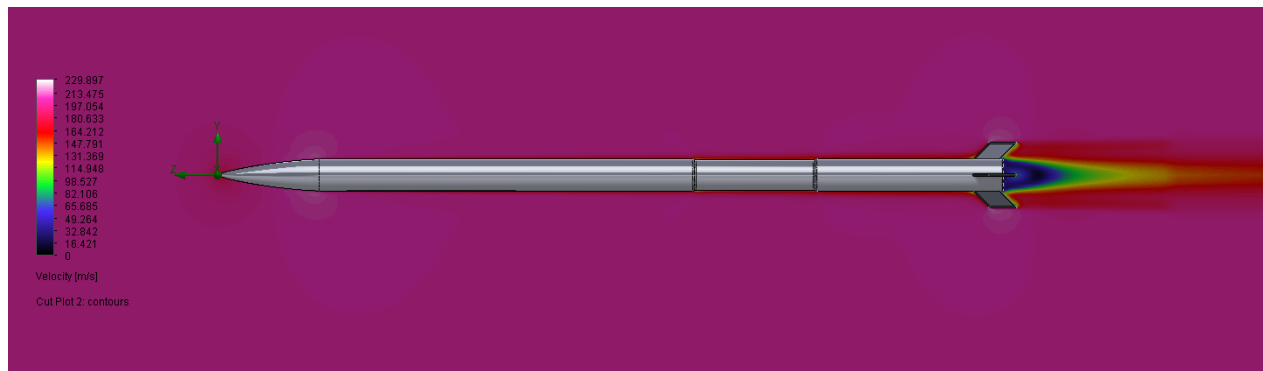


Figure 11: Velocity graph at 0.6 Mach for R6-NoEndcone model

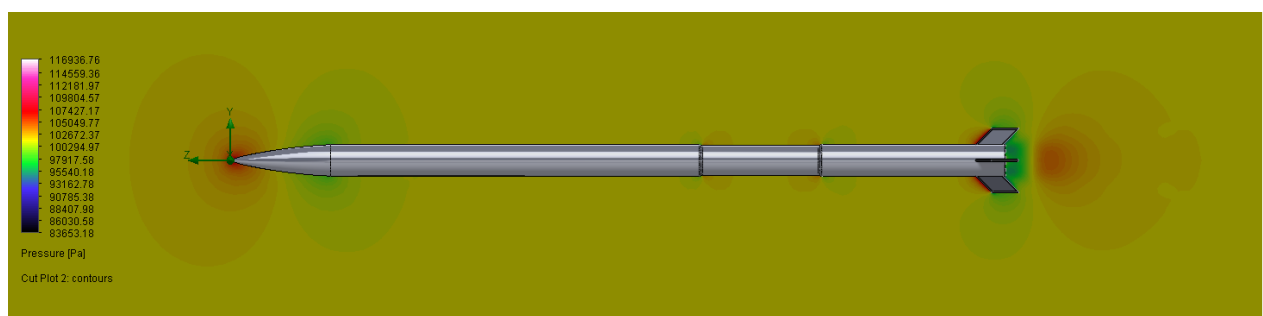


Figure 12: Pressure graph at 0.6 Mach for R6-NoEndcone model

4.2 Ansys Fluent with meshing

- Domena i mesh
- Kolorki dla 0.2, 0.5, 0.8

5 Results and discussion

- Wykresy CD solida
- Wykres CD fluenta
- porównanie CD dla wyników solida i ansysa jakąś tam statystyką z użyciem pythona(ja to zrobie)
- Podsumowanie że wyszedł lepszy dla endcone(co się zgadza z literaturą i przewidywaniami) oraz jakieś tam gadu gadu o Solidzie że gorszy.