# Rocket Project

## ASTE 475

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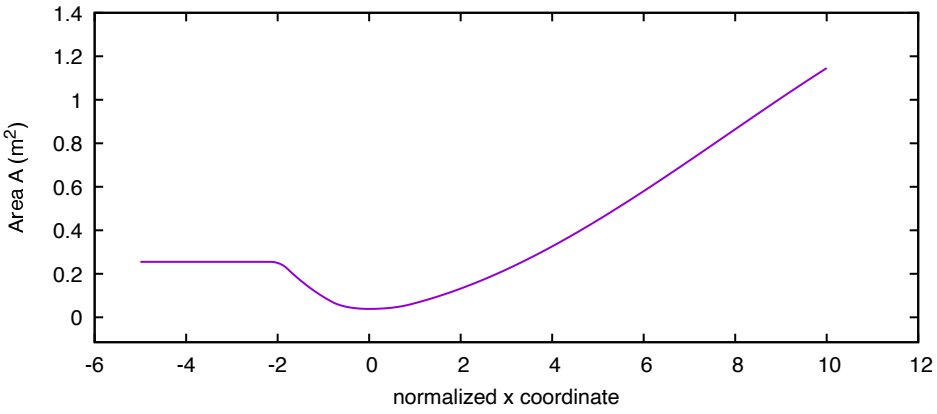


Figure 1: Area $A$ $(\mathrm{m}^2)$ vs $x$ position.

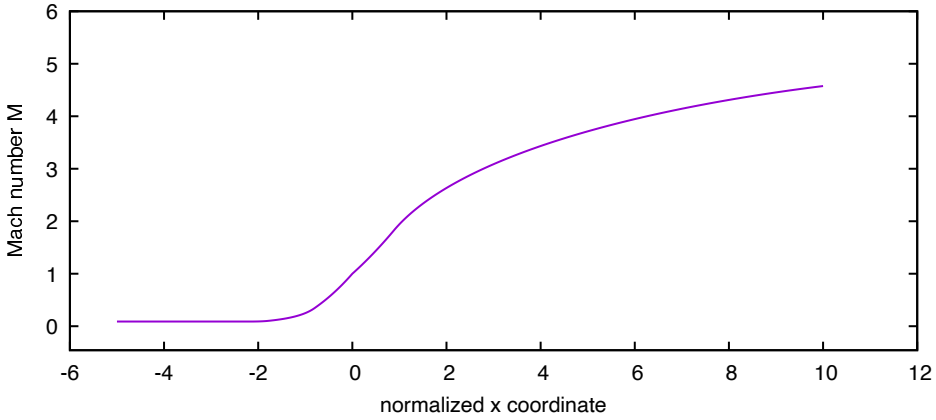


Figure 2: Mach number $M$ vs $x$ position.

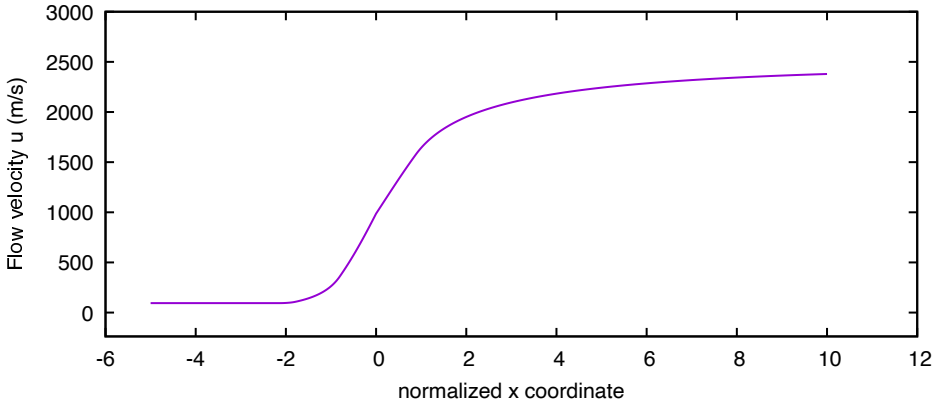


Figure 3: $u$ $(\mathrm{m\,s^{-1}})$ vs $x$ position.

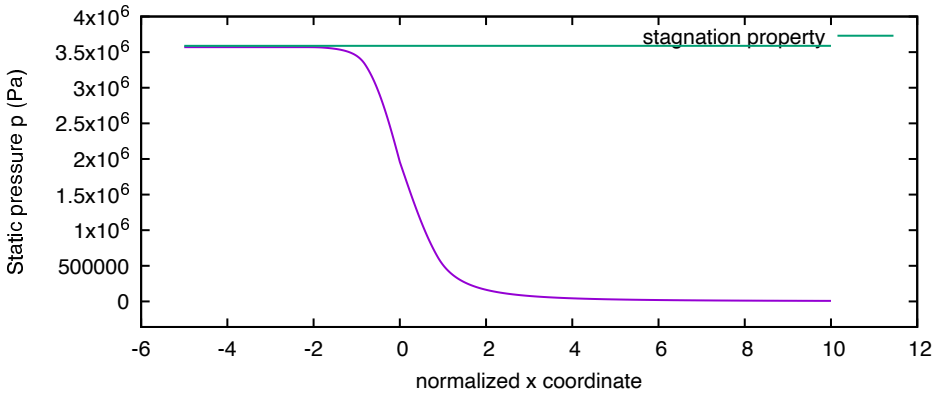


Figure 4: $p$ (Pa) vs $x$ position.

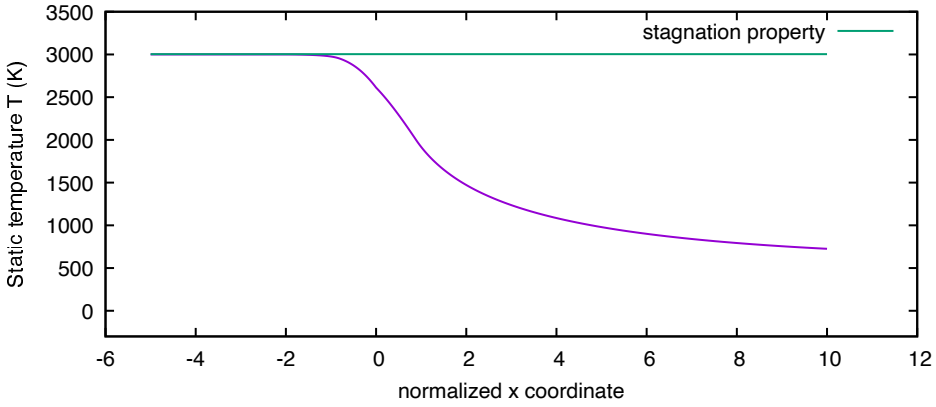


Figure 5: $T$ (K) vs $x$ position.

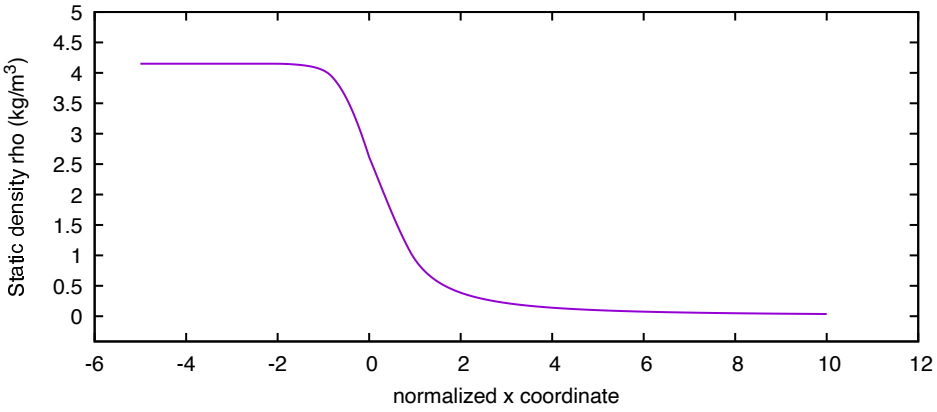


Figure 6: $\rho$ $(\mathrm{kg\,m^{-3}})$ vs $x$ position.

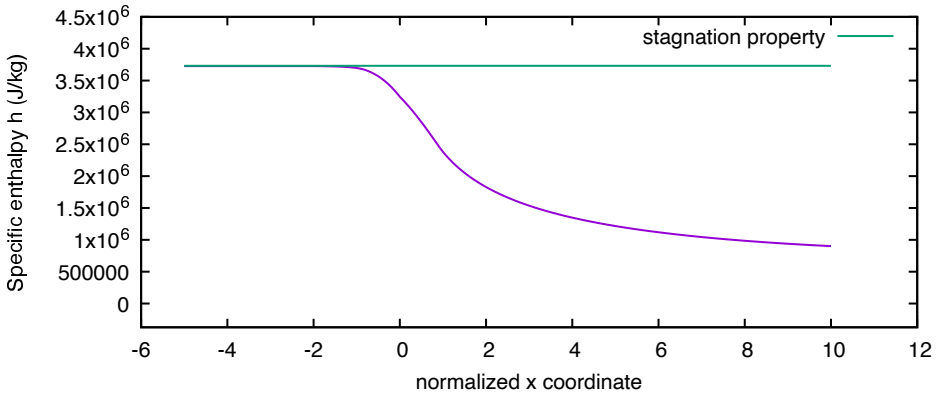


Figure 7: $h$ $(\mathrm{J\,kg^{-1}})$ vs $x$ position.

# Task 4

We have $p_{b,sub} = 3\,587\,540.448\,\mathrm{Pa}$, $p_{b,sup} = 7604.393\,017\,\mathrm{Pa}$, and $p_{b,exitshock} = 178\,978.6579\,\mathrm{Pa}$.

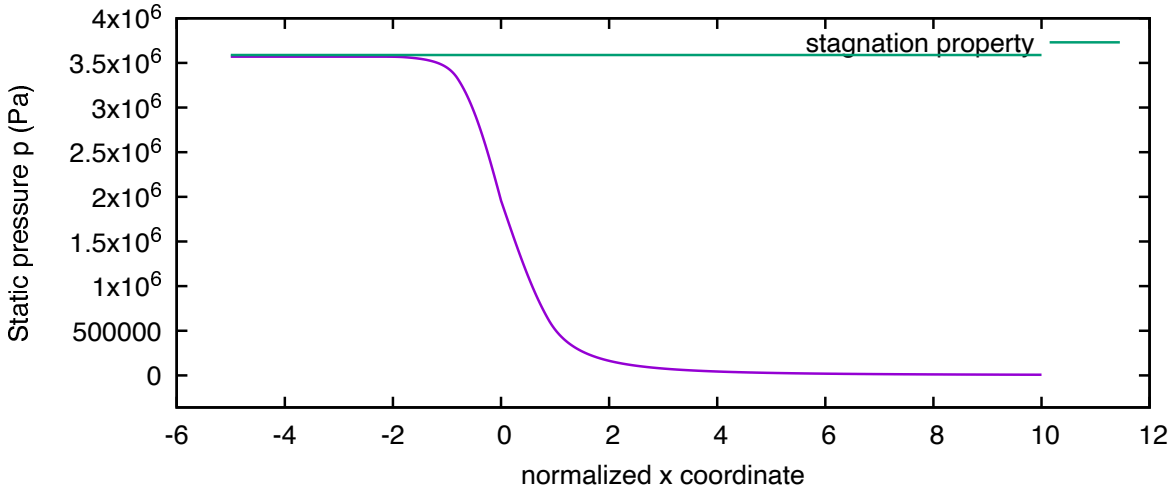


Figure 8: Oblique shock outside

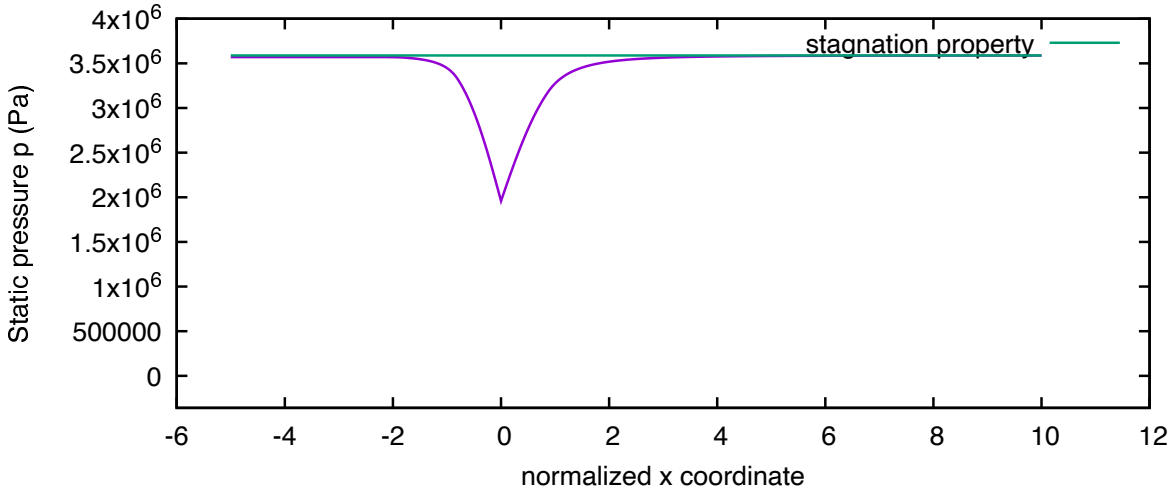


Figure 9: Subsonic choked isentropic.

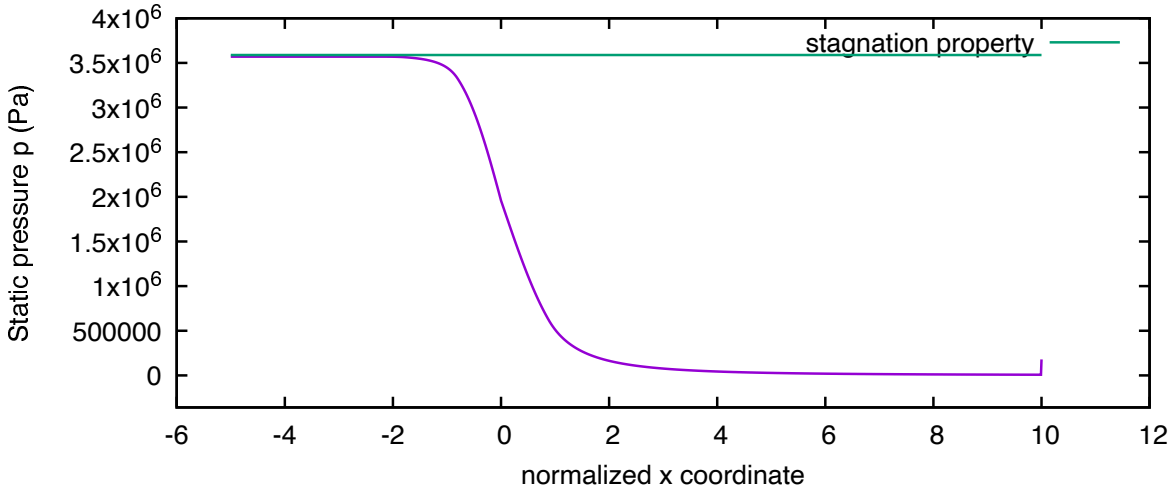


Figure 10: Normal shock at exit.

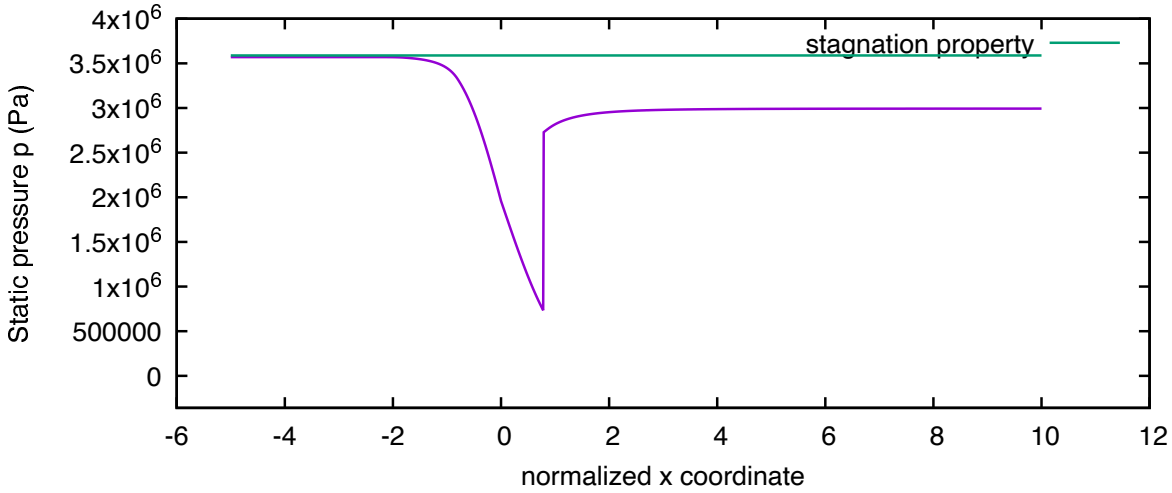


Figure 11: Normal shock inside.

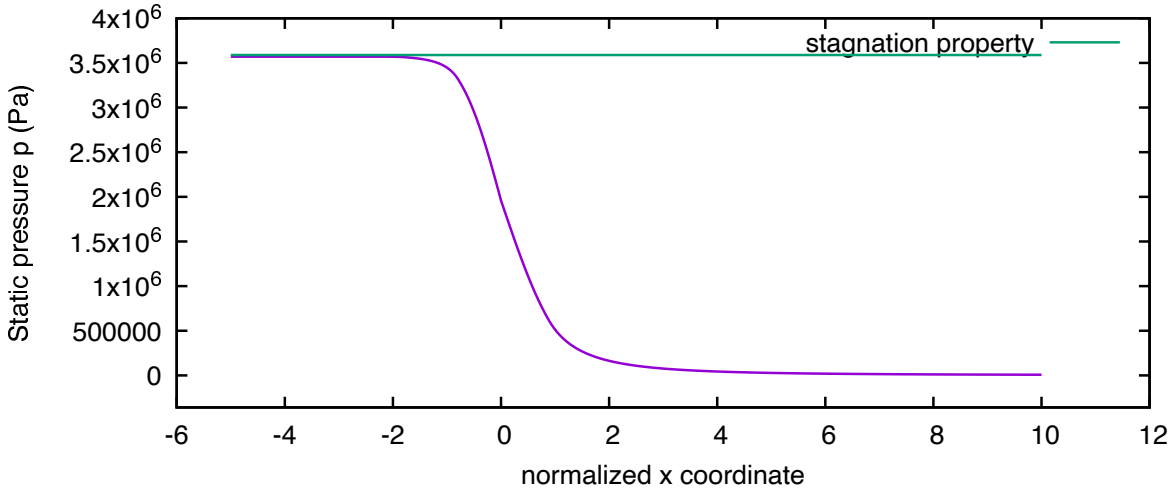


Figure 12: Expansion waves outside

# Task 5

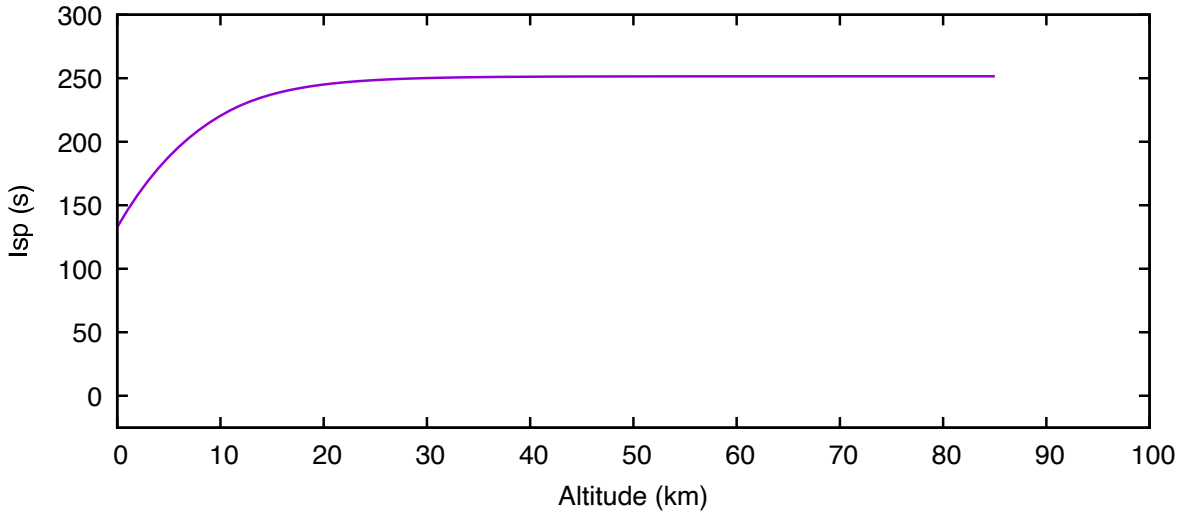


Figure 13: Plot of specific impulse $I_{sp}$ vs altitude for given nozzle geometry.

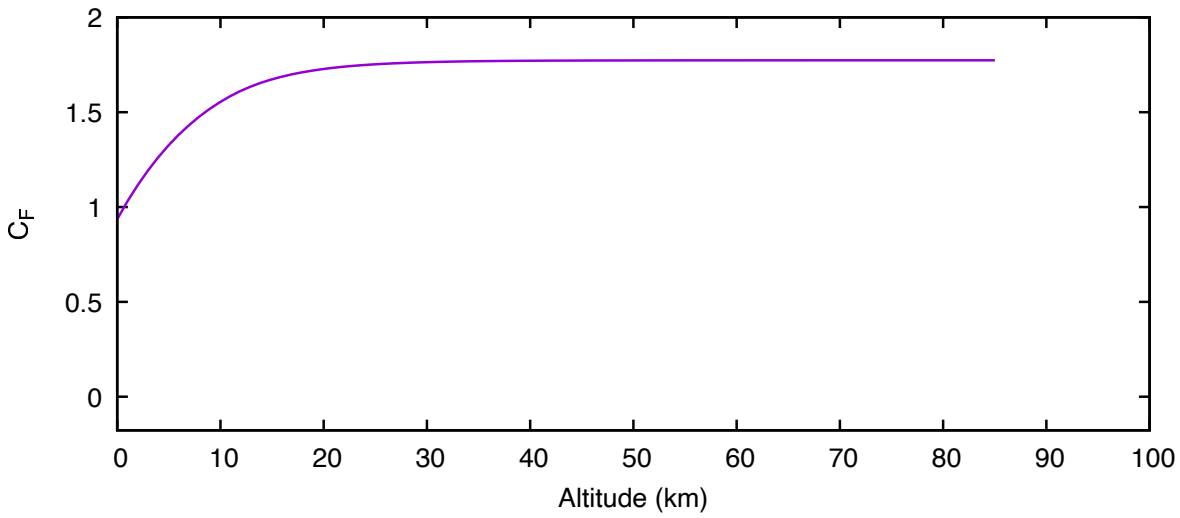


Figure 14: Plot of thrust coefficient $C_F$ vs altitude for given nozzle geometry.