Generic Engine Performance

Chapter 4 of the lecture notes only deals with ideal engines. More realistic values might be obtained, if generic engine performance data is used.

Generic turbojet engines performance data

Relative thrust (Schub/Standschub) versus Mach number (Machzahl) for different altitudes (H) and bypass rations (BPR).

The take-off (Start) is performed with take-off thrust rating. Relative thrust for altitude up to 6 km is given only for maximum climb rating (max. Steigleistg.), whereas relative thrust for altitude between 9 km and 13 km is given for both maximum climb rating (max. Steigleistung) and maximum cruise rating (max. Reiseleistg.). It is evident that thrust is reduced when going

- from take-off thrust rating
- to maximum climb rating
- to maximum cruise rating.

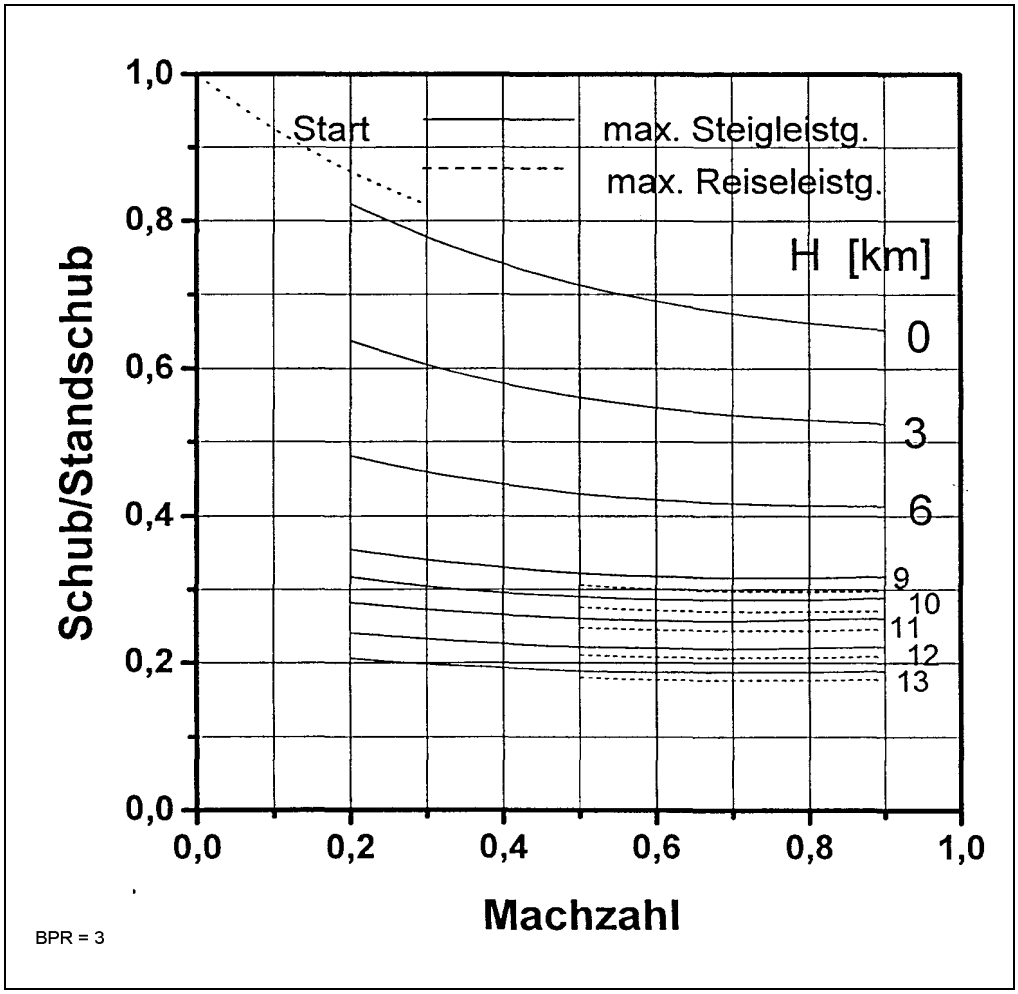

Figure 1 Relative thrust at bypass ratio 3

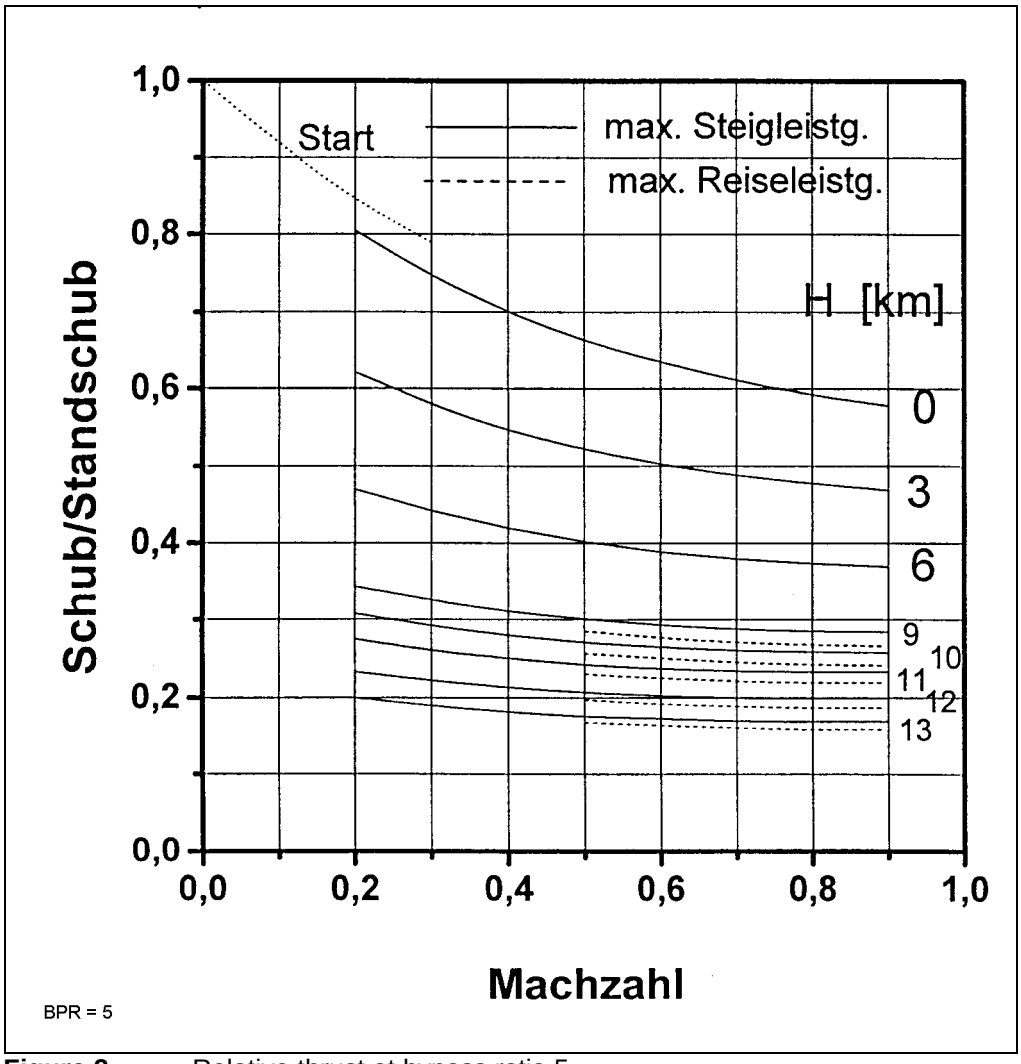

Figure 2 Relative thrust at bypass ratio 5

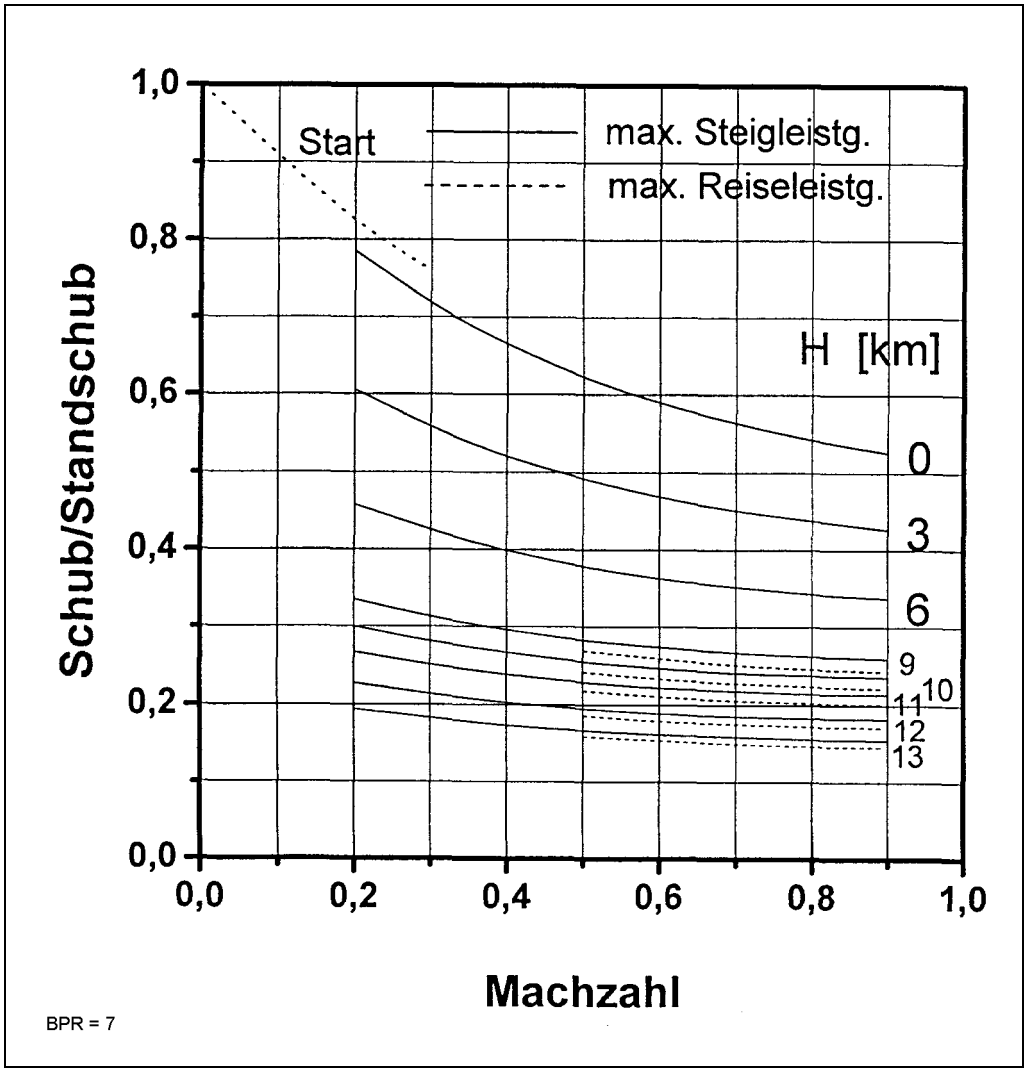

Figure 3 Relative thrust at bypass ratio 7

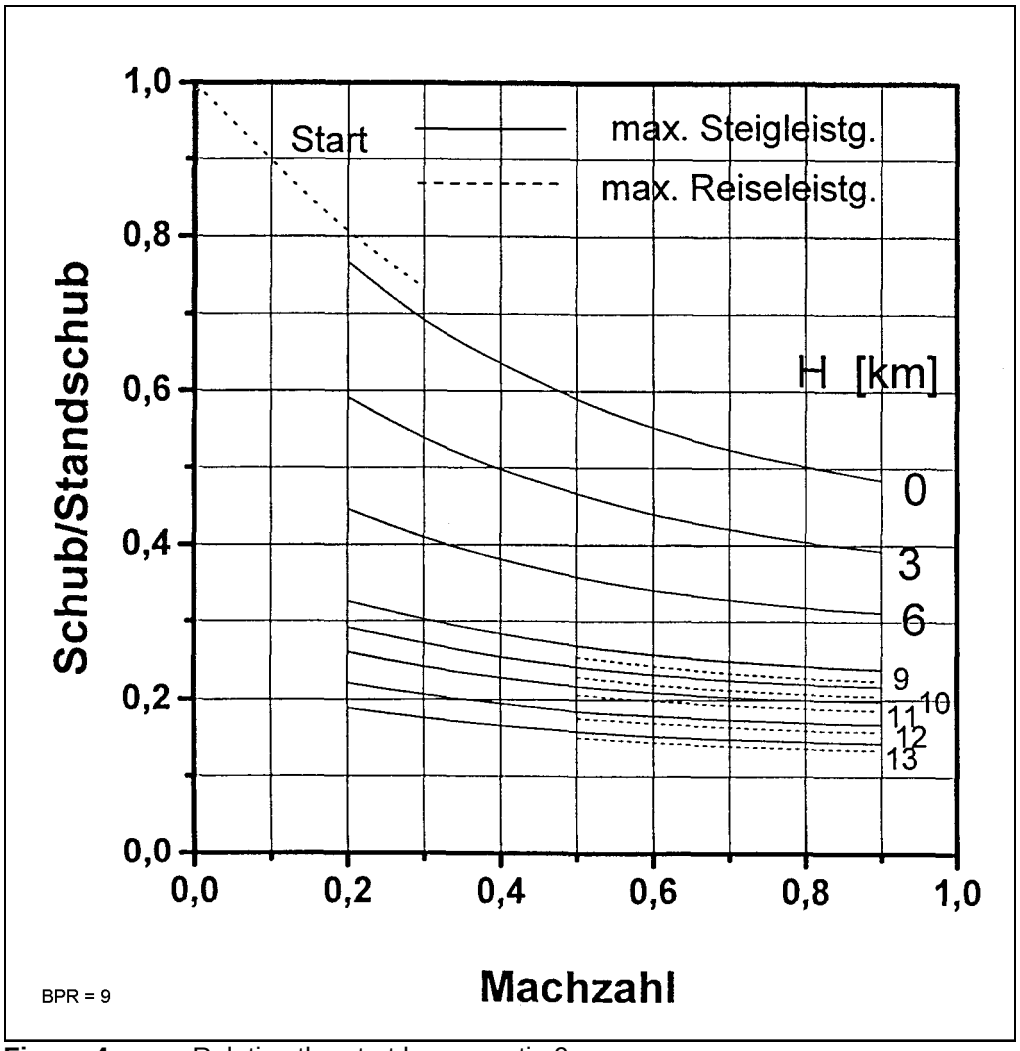

Figure 4 Relative thrust at bypass ratio 9

Depending on cruise altitude h_{CR} und bypass ratio *BPR*, the relative thrust can be calculated for usual cruise Mach numbers around $M_{CR} \approx 0{,}8$ from

$$\frac{T_{CR}}{T_{TO}} = (0.0013BPR - 0.0397)\frac{1}{\text{km}}h_{CR} - 0.0248BPR + 0.7125 \quad . \tag{1}$$

This equation was derived from the data in Figure 1 through 4.

Source of all Figures 1 through 5:

MARCKWARDT, Klaus: *Flugmechanik*. Hamburg, Fachhochschule Hamburg, Fachbereich Fahrzeugtechnik, Vorlesungsskript, 1998

Generic efficiencies of variable pitch propellers

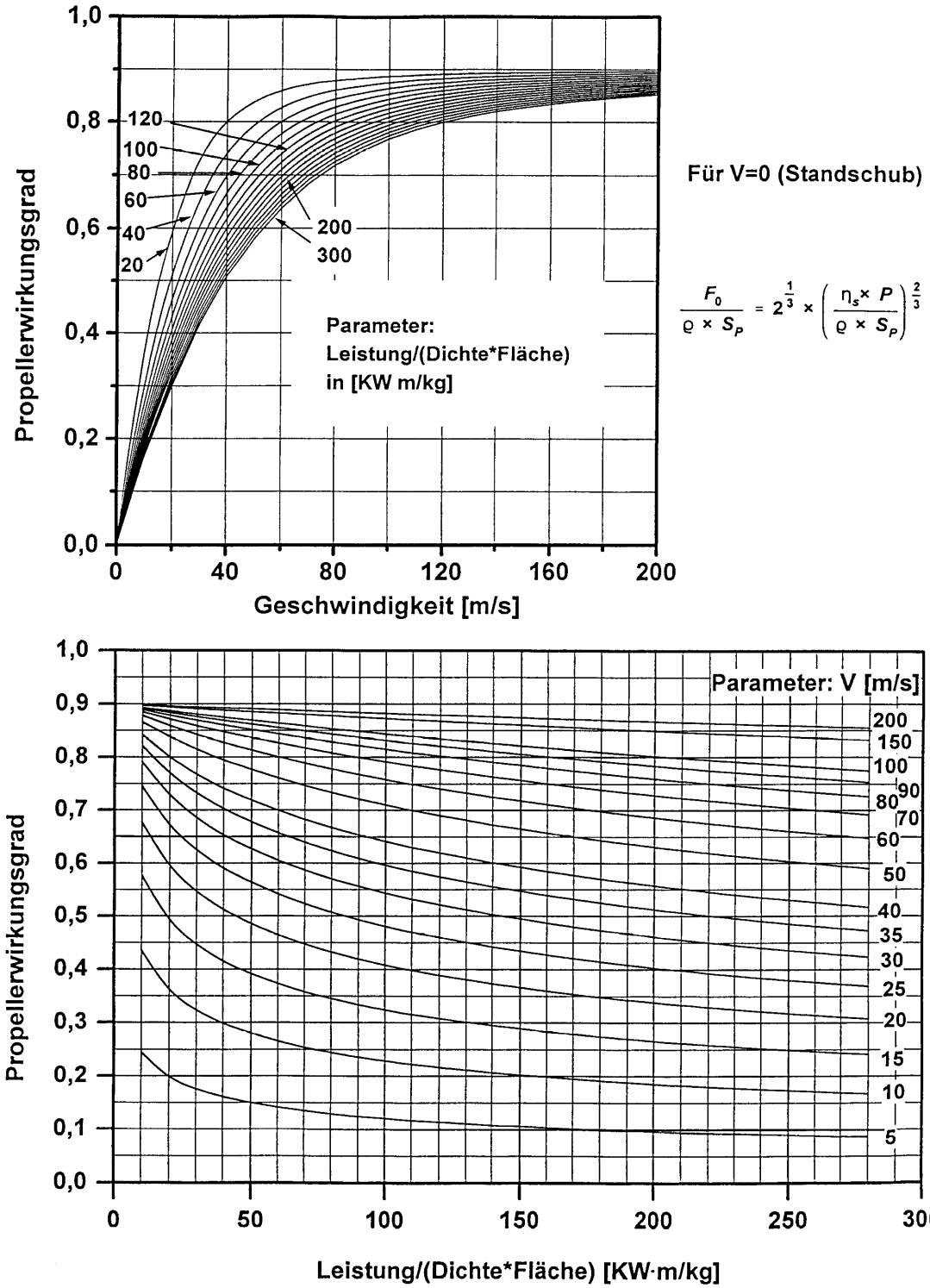

Figure 5 Propeller efficiency (Propellerwirkungsgrad) as function of aircraft speed (Geschwindigkeit). Parameter used is shaft power (Leistung) devided by air density (Dichte) times propeller area (Fläche). For the aircraft with V=0 a separate equation is provided to calculate the thrust at rest