In 4.7 you only need to scan the statement of the theorems. (Skip 4.8-4.9) Read Ch 5.4 (small gain theorem) and 6.1–6.3 on passivity and the article by Rantzer on the K-Y-P lemma.

Exercises on Chapters 4 & 6

Exercise 2.1 This problem concerns the importance of the *decresence condition* for the Lyapunov function when analysing non-autonomous/time-varying systems.

Consider the mass-damper system

$$\ddot{x} + d(t)\dot{x} + x = 0$$

with time-varying damping $d(t) = (2 + e^t)$.
(a) Show that the origin is an equilibrium. Show also that the system is stable with the energy as a Lyapunov function candidate.
(b) Determine the analytic solution to the system from the initial state $(x(0), \dot{x}(0)) = (2, -1)$. Make a simulation of the system for some different initial conditions.

Exercise 2.2 = Kha 4.13 (1)

Exercise 2.3 = Kha 4.17

Exercise 2.4 = Kha 6.2

Exercise 2.5 = Kha 6.7

Exercise 2.6 = Kha 6.10