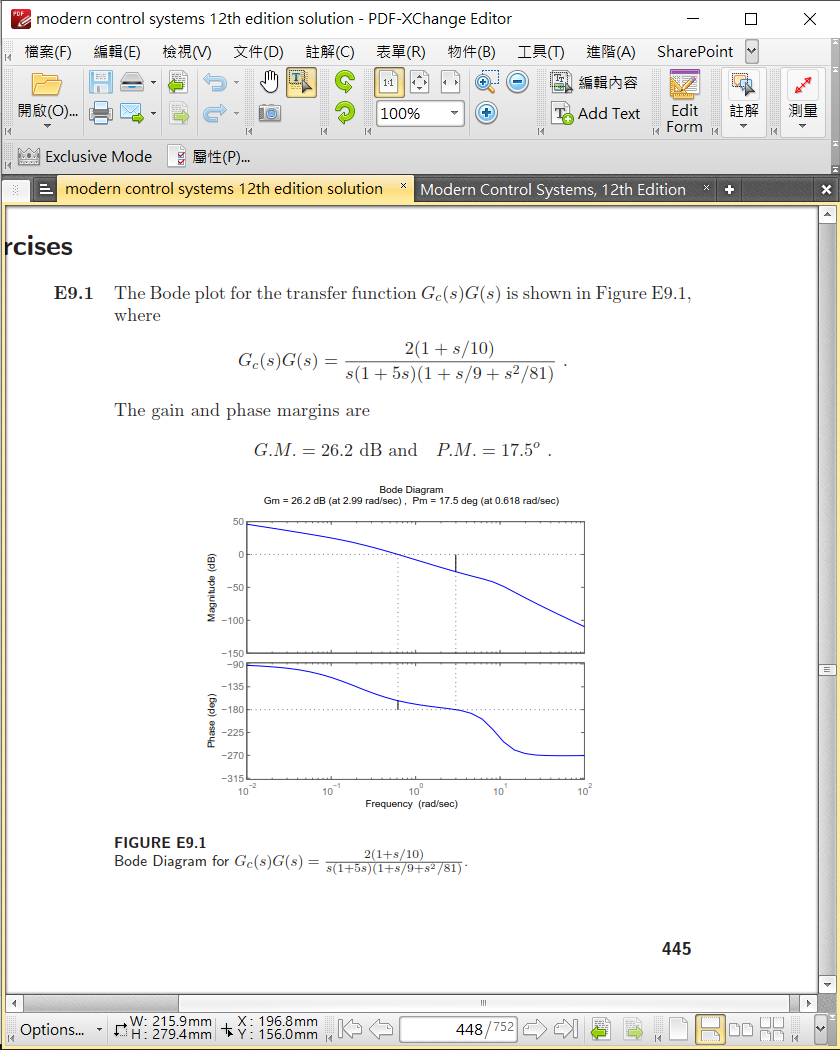
(E9.1) A system has the loop transfer function

Plot the Bode diagram. Show that the phase margin is approximately 17.5° and that the gain margin is approximately 26.2 dB.

Ans.



(P9.2) Sketch the Nyquist plots of the following loop transfer functions L(s) = Gc(s)G(s), and determine whether the system is stable by applying the Nyquist criterion:

If the system is stable, find the maximum value for K by determining the point where the Nyquist plot crosses the w-axis.

Ans.

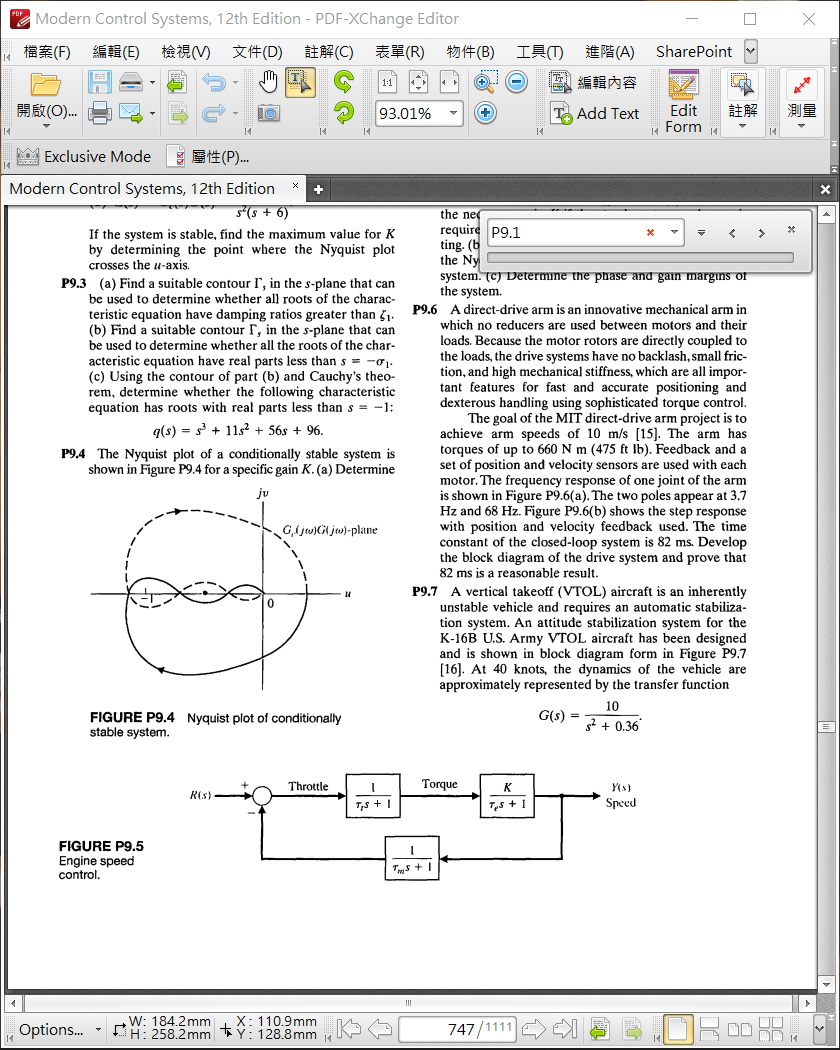
* To determine the real axis crossing, we let

or

* Then,
* So, -K/6 > -1 for stability. Thus K < 6 for a stable system.
* The polar plot never encircles the -1 point, so the system is stable for all gains K (See Figure 10 in Table 9.6 in Dorf & Bishop).

(P9.4) The Nyquist plot of a conditionally stable system is shown in Figure P9.4 for a specific gain K.

1. Determine whether the system is stable and find the number of roots (if any) in the right-hand s-plane. The system has no poles of Gc(s)G(s) in the right half-plane.
2. Determine whether the system is stable if the -1 point lies at the dot on the axis.



Ans.

1. P = 0, N = 2, therefore Z = 2. The system has two roots in the right-hand s-plane.
2. In this case, N = +1 − 1 = 0, so Z = 0. Therefore, the system is stable.