Problem Set #4

1. Given a controller $k(s)$, under what conditions will the closed-loop be robustly stable (RS) for $g_p(s)$ given by a nominal model $g(s)$ and an additive perturbation as illustrated? You may assume that $g(s)$, $\Delta_a(s)$, and $w_a(s)$ are stable transfer functions.

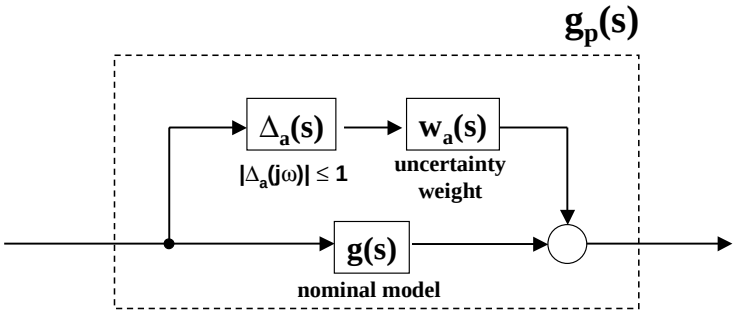

Figure 1: Additive model uncertainty.

2. For the above system, apply the following performance specification

$$|w_p S| < 1, \qquad \forall \omega \tag{1}$$

where $S = [1+gk]^{-1}$ is the sensitivity function, and $w_p(s)$ is a performance weight (same as condition (7.55) in your textbook). Under what conditions will (1) be satisfied for all potential models in Figure 1?