Chapter 5. Appendix

5.1. PR Controller Mapped to 2p2z

PR controller is a popular controller type used in design of PV inverters. The following section details how the PR controller coefficients can be mapped into a 2p2z structure available in the solar library.

$G_{PR} = K_p + K_i \frac{s}{s^2 + \omega^2}$ where ω is the resonant pole frequency in radians

Using bi-linear transformation $s = \frac{2}{T}\frac{(z-1)}{(z+1)}$

$$G_{PR}(z) = K_p + \frac{K_i \frac{2(z-1)}{T(z+1)}}{\frac{4(z-1)^2}{T^2(z+1)^2} + \omega^2} = \frac{\left(K_p + \frac{2K_iT}{(4+T^2\omega^2)}\right) + \left(2K_p \frac{(T^2\omega^2-4)}{(T^2\omega^2+4)}\right)z^{-1} + \left(K_p - \frac{2K_iT}{(4+T^2\omega^2)}\right)z^{-2}}{1 + 2\left(\frac{(T^2\omega^2-4)}{(T^2\omega^2+4)}\right)z^{-1} + z^{-2}}$$

Comparing this with the generic structure of 2p2z as implemented in the solar lib

$$\frac{U(z)}{E(z)} = \frac{b_0 + b_1 z^{-1} + b_2 z^{-2}}{1 - a_1 z^{-1} - a_2 z^{-2}}$$

We get : $b_0 = \left(K_p + \frac{2K_iT}{(4+T^2\omega^2)}\right)$, $b_1 = \left(2K_p \frac{(T^2\omega^2-4)}{(T^2\omega^2+4)}\right)$, $b_2 = \left(K_p - \frac{2K_iT}{(4+T^2\omega^2)}\right)$,

$a_1 = -2\left(\frac{(T^2\omega^2-4)}{(T^2\omega^2+4)}\right)$, $a_2 = -1$