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Project: Controller Design for the project: "DC-Bus Voltage Control in Controlled DC-Voltage Power Port".
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Parameters

$C_{dc} := 9625 \cdot 10^{-6}$	DC-Bus Capacitor
$f_s := 3240$	Switching Frequency [Hz]
$V_{DC} := 1450$	DC-Bus voltage reference [V]
$H_v := \frac{1}{1000}$	Voltage Sensor Gain
$V_{t_pk} := 1$	Carrier Peak Voltage
$f_c := 6.2$	Cut-off Frequency in Hz
$MF_d := 55$	Desired Phase Margin [degree]
$T_{dc}(f) := \frac{-2}{C_{dc} \cdot 2 \cdot \pi \cdot f \cdot i} \cdot H_v \cdot \frac{1}{V_{t_pk}}$	DC-Bus Voltage Plant. According to Chapter 7 in "Voltage-Sourced Converters in Power Systems: Modeling, Control and Applications" by A. Yazdani and R. Iravani. Here, it is included the Sensor Gain and the PWM transfer Function

$$\text{Mod}_{T_{dc}}(f) := 20 \cdot \log(|T_{dc}(f)|)$$

$$\text{Fase}_{T_{dc}}(f) := \arg(T_{dc}(f)) \cdot \frac{180}{\pi}$$

PI Controller

$$k_{pidc} := 125$$

$$w_{zbdc} := 42$$

$$C_{PI_{dc}}(f) := k_{pidc} \cdot \frac{2 \cdot \pi \cdot f \cdot i + w_{zbdc}}{2 \cdot \pi \cdot f \cdot i}$$

$$\text{Mod}_{C_{PI_{dc}}}(f) := 20 \cdot \log(|C_{PI_{dc}}(f)|)$$

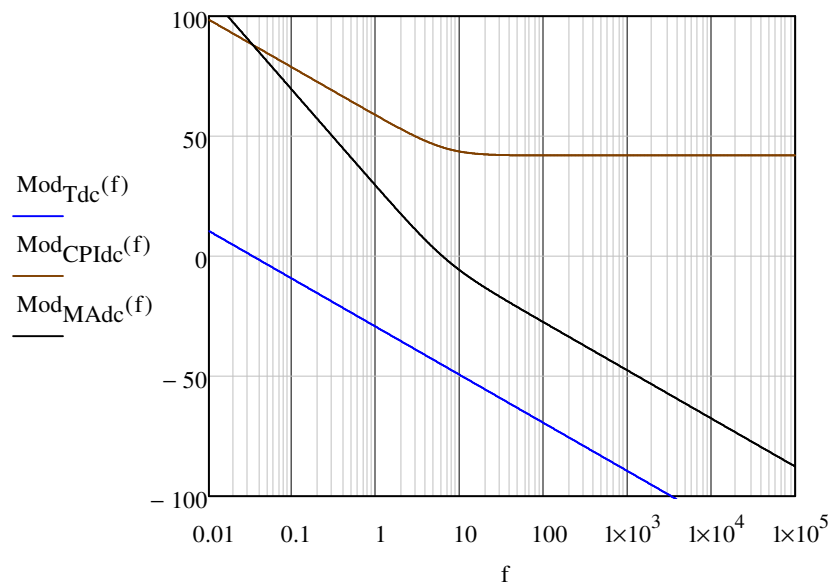
$$\text{Fase}_{\text{CPIdc}}(f) := \arg(\text{CPIdc}(f)) \cdot \frac{180}{\pi}$$

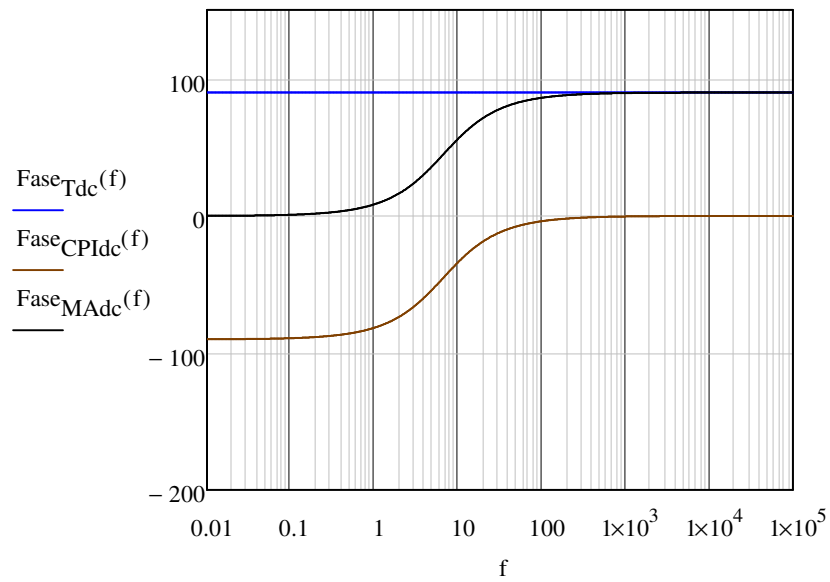
Open-Loop Bode Diagrams (Voltage Plant, PI controller and Total open-loop)

$$\text{MA}_{\text{dc}}(f) := \text{T}_{\text{dc}}(f) \cdot \text{CPIdc}(f)$$

$$\text{Mod}_{\text{MAdc}}(f) := \text{Mod}_{\text{Tdc}}(f) + \text{Mod}_{\text{CPIdc}}(f)$$

$$\text{Fase}_{\text{MAdc}}(f) := \text{Fase}_{\text{Tdc}}(f) + \text{Fase}_{\text{CPIdc}}(f)$$



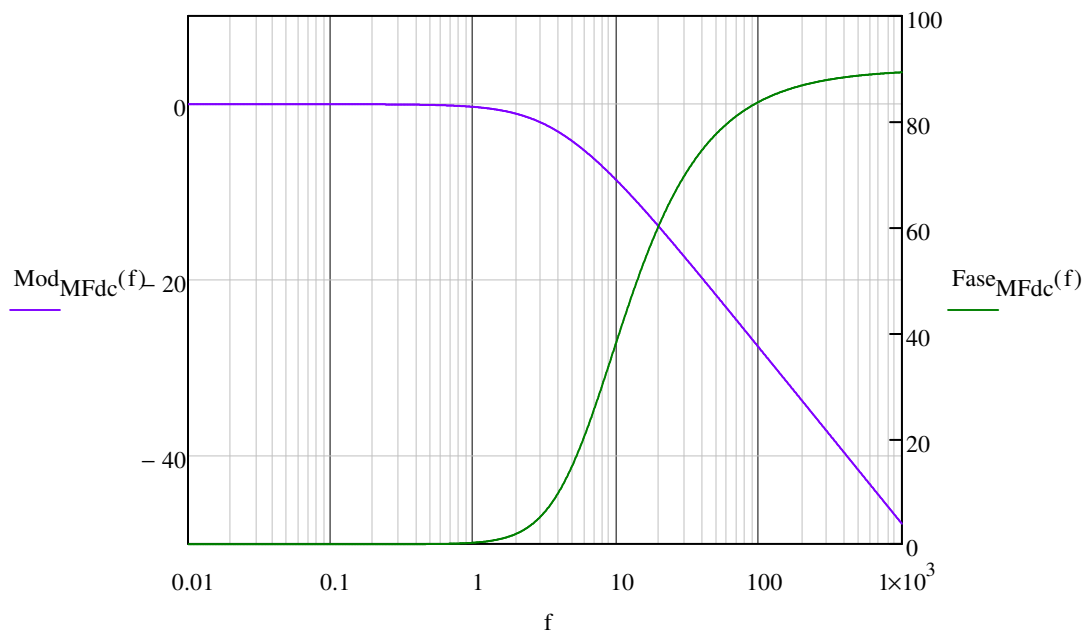


Closed-Loop Bode Diagrams

$$\text{MF}_{\text{dc}}(f) := \frac{C_{\text{PIdc}}(f) \cdot T_{\text{dc}}(f)}{1 + C_{\text{PIdc}}(f) \cdot T_{\text{dc}}(f)}$$

$$\text{Mod}_{\text{MFdc}}(f) := 20 \cdot \log(|\text{MF}_{\text{dc}}(f)|)$$

$$\text{Fase}_{\text{MFdc}}(f) := \arg(\text{MF}_{\text{dc}}(f)) \cdot \frac{180}{\pi}$$



PSIM Implementation

$$K_{PSIM} := k_{pidc} = 125$$

$$T_{sPSIM} := \frac{1}{w_{zbdc}} = 0.024$$

