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Clear["Global*"];

 $\omega = 2000;$ 

 $c1[\zeta] := -\zeta\omega + \omega\sqrt{\zeta^2 - 1};$ 
 $c2[\zeta] := -\zeta\omega - \omega\sqrt{\zeta^2 - 1};$ 
 $H[\zeta] := \frac{\omega^2}{(s - c1[\zeta])(s - c2[\zeta])};$ 

StepR[t_,  $\zeta$ _] :=  $\frac{\omega^2}{(c1[\zeta] - c2[\zeta])} * \left( \frac{e^{c1[\zeta]t} - 1}{c1[\zeta]} - \frac{e^{c2[\zeta]t} - 1}{c2[\zeta]} \right)$ 
(*UnitImpulseIntegratedbyhand  $\rightarrow$  UnitstepResponse*)

H1 =  $\frac{\omega^2}{(s + \omega)^2}$  (*Transferfunctionwhen $\zeta = 1$ *)
(*RelevantTimeDomainFunction  $\rightarrow t * e^{-\omega t} * u(t)$  StepR1meanstheIntegralofitasbelow*)

StepR1[t_] :=  $\omega^2 \int_0^t \tau * \text{Exp}[-\omega\tau] * \text{UnitStep}[\tau] d\tau$ 

Plot[{StepR[t, 0.25], StepR[t, 0.5], StepR[t, 0.75], StepR1[t], StepR[t, 1.5]},
{t, 0, 0.010}, PlotRange  $\rightarrow$  All, PlotLegends  $\rightarrow$  "Expressions"]

Manipulate[ControlPoleZeroPlot[{H[ $\zeta$ ]},
PlotLabel  $\rightarrow$  StringForm["Pole Zero Plot for  $\zeta = \text{\`T}$ ",  $\zeta$ ],
PlotLegends  $\rightarrow$  StringForm[" $\zeta = \text{\`T}$ ",  $\zeta$ ], AxesLabel  $\rightarrow$  {"Re", "Im"}], {{ $\zeta$ , 0.5}, 0, 1}]

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