Model Documentation of the 'Turbo-Generator'

1 Nomenclature

1.1 Nomenclature for Model Equations

x	state vector
u	control input vector
w	noise vector
z	regulated output vector
y	measurement vector

2 Model Equations

State Vector and Input Vector:

$$x \in \mathbb{R}^1 0 u \qquad \in \mathbb{R}^2 w \in \mathbb{R}^1 0 z \qquad \in \mathbb{R}^1 0 y \in \mathbb{R}^2$$

System Equations:

$$\dot{x}(t) = Ax(t) + B_1 w(t) + Bu(t) \tag{1a}$$
$$z(t) = C_1 x(t) + D_{11} w(t) + D12u(t) \tag{1b}$$
$$y(t) = Cx(t) + D21w(t) \tag{1c}$$

Outputs: z

2.1 Exemplary parameter values

Symbol	Value
A	$\begin{bmatrix} 0 & 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -0.11323 & -0.98109 & -11.847 & -11.847 & -63.08 & -34.339 & -34.339 & -27.645 \\ 324.121 & -1.1755 & -29.101 & 0.12722 & 2.83448 & -967.73 & -678.14 & -678.14 & 0 \\ -127.3 & 0.46167 & 11.4294 & -1.0379 & 13.1237 & 380.079 & 266.341 & 266.341 & 0 \\ -186.05 & 0.67475 & 16.7045 & 0.86092 & -17.068 & 555.502 & 389.268 & 389.268 & 0 \\ 341.917 & 1.09173 & 1052.75 & 756.465 & 756.465 & -29.774 & 0.16507 & 3.27626 & 0 \\ -30.748 & -0.09817 & -94.674 & -68.029 & -68.029 & 2.67753 & -2.6558 & 4.88497 & 0 \\ -302.36 & -0.96543 & -930.96 & -668.95 & -668.95 & 26.3292 & 2.42028 & -9.5603 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & -1.6667 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
B	$\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 1.6667 & 0 \\ 0 & 10.0 \end{bmatrix}$
B_1	$\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 1.6667 & 0 \\ 0 & 10.0 \end{bmatrix}$
C_1	$\begin{bmatrix} 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1.0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1.0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1.0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1.0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1.0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1.0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1.0 \end{bmatrix}$
C	$\begin{bmatrix} 1.0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ -0.49134 & 0 & -0.63203 & 0 & 0 & -0.20743 & 0 & 0 & 0 & 0 \end{bmatrix}$
D_{11}	$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$
D_{12}	$\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$

3 Derivation and Explanation

This model is part of the "'COMPleib"' - library and wasautomatically imported into ACKREP.
The original description was:
TG1 Turbo-Generator Y. S. Hung and A. G. J. MacFarlane, "Multivariable feedback A quasi-classical approach", Springer-Verlag, "Lecture Notes in Control and Information Sciences", 1982 p. 117/167

4 Simulation

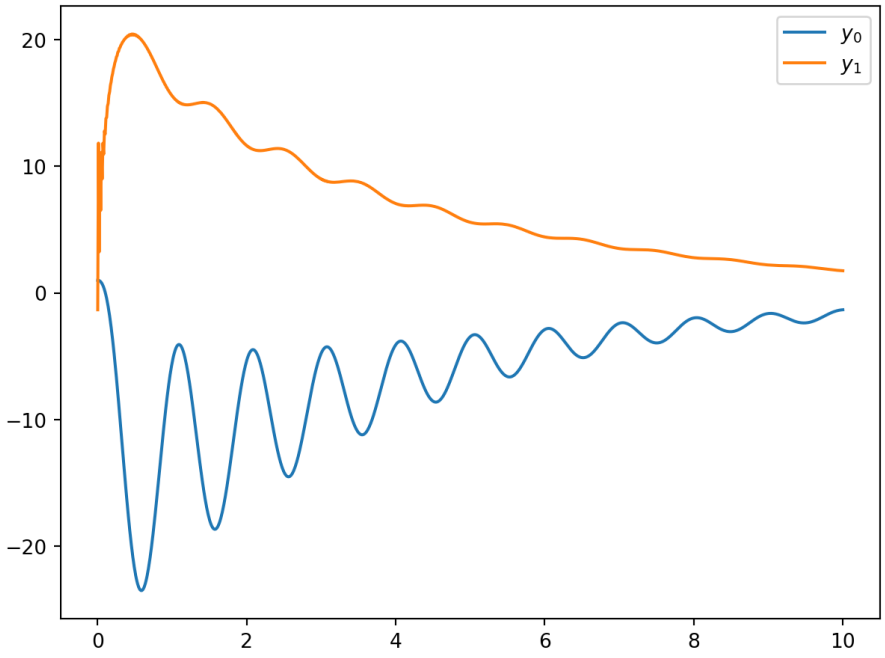

Figure 1: Simulation of the Turbo-Generator.

References

[1] . S. Hung and A. G. J. MacFarlane, "Multivariable feedback A quasi-classical approach", Springer-Verlag, "Lecture Notes in Control and Information Sciences", 1982 p. 117/167