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Exercises - Chapter 02

Problem 02 – Smith-McMillan

Note: Smith-McMillan is discussed in chapter 03 and it is the authors' mistake to haveit by the end of chapter02.

G1 =

$$\begin{pmatrix} \frac{s}{(s+1)^2\,(s+2)^2} & \frac{s}{(s+2)^2} \\ -\frac{s}{(s+2)^2} & -\frac{s}{(s+2)^2} \end{pmatrix}$$

The Lowest Common Multiplies of the given matrix denominators is:

$$(s+1)^2\,(s+2)^2$$

SmithMcMillan =

$$\begin{pmatrix} \frac{s}{(s^2+3\,s+2)^2} & 0 \\ 0 & \frac{s^2}{s+2} \end{pmatrix}$$

G2 =

$$\begin{pmatrix} \frac{s+2}{s+1} & \frac{1}{s+2} \\ \frac{1}{s+1} & \frac{(s+1)\,(s+3)}{(s+2)^2} \end{pmatrix}$$

The Lowest Common Multiplies of the given matrix denominators is:

$$(s+1)\,(s+2)^2$$

SmithMcMillan =

$$\begin{pmatrix} \frac{1}{(s+1)\,(s+2)^2} & 0 \\ 0 & s^3+6\,s^2+10\,s+4 \end{pmatrix}$$

G4 =

$$\begin{pmatrix} (s+1)\,(s+2) & \frac{(s+1)^2}{s+2} \\ -\frac{s+2}{(s+1)^2} & -\frac{1}{s+2} \end{pmatrix}$$

The Lowest Common Multiplies of the given matrix denominators is:

$$(s+1)^2\ (s+2)$$

SmithMcMillan =

$$\begin{pmatrix} \frac{1}{(s+1)^2\ (s+2)} & 0 \\ 0 & -s\ (s+1)^2\ (s+2) \end{pmatrix}$$

G5 =

$$\begin{pmatrix} \frac{1}{s+1} & \frac{2\,s+4}{(s+1)\ (s+3)} & \frac{1}{s+4} \\ 0 & \frac{1}{s+2} & \frac{1}{s+4} \\ \frac{1}{s+1} & -\frac{(s+1)\ (s+3)-2\ (s+2)^2}{(s+1)\ (s+2)\ (s+3)} & 0 \end{pmatrix}$$

The Lowest Common Multiplies of the given matrix denominators is:

$$(s+1)\ (s+2)\ (s+3)\ (s+4)$$

SmithMcMillan =

$$\begin{pmatrix} \frac{1}{s^4+10\,s^3+35\,s^2+50\,s+24} & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

G8 =

$$\begin{pmatrix} \frac{1}{s+1} & \frac{2}{s+1} & \frac{1}{s+4} \\ 0 & \frac{1}{s+2} & \frac{1}{s+4} \\ \frac{1}{s+1} & \frac{2\,s+6}{(s+1)\ (s+2)\ (s+3)} & 0 \end{pmatrix}$$

The Lowest Common Multiplies of the given matrix denominators is:

$$(s+1)\ (s+2)\ (s+4)$$

SmithMcMillan =

$$\begin{pmatrix} \frac{1}{s^3+7\,s^2+14\,s+8} & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

G9 =

$$\begin{pmatrix} \frac{1}{(s+3)\,(s+4)} & \frac{1}{s+1} \\ \frac{1}{s+3} & 0 \end{pmatrix}$$

The Lowest Common Multiplies of the given matrix denominators is:

$$(s+1)\,(s+3)\,(s+4)$$

SmithMcMillan =

$$\begin{pmatrix} \frac{1}{s^3+8\,s^2+19\,s+12} & 0 \\ 0 & -s-4 \end{pmatrix}$$

G10 =

$$\begin{pmatrix} \frac{s^3-s^2+1}{s^4} & \frac{1}{s^4} & -\frac{s^3-s^2+2}{s^4} \\ \frac{\frac{3\,s}{2}+1}{s^4} & \frac{s+1}{s^4} & -\frac{\frac{3\,s}{2}+2}{s^4} \\ -\frac{-s^3+9\,s^2+s-1}{s^4} & -\frac{s^2-1}{s^4} & -\frac{-s^3+s^2+s}{s^4} \end{pmatrix}$$

The Lowest Common Multiplies of the given matrix denominators is:

$$2\,s^4$$

SmithMcMillan =

$$\begin{pmatrix} \frac{1}{2\,s^4} & 0 & 0 \\ 0 & \frac{1}{s^4} & 0 \\ 0 & 0 & -\frac{-4\,s^6+20\,s^5+10\,s^4-24\,s^3-s^2+4\,s+2}{s^3} \end{pmatrix}$$

G12 =

$$\begin{pmatrix} \frac{1}{(s+1)^2} & \frac{1}{(s+1)\ (s+2)} \\ \frac{1}{(s+1)\ (s+2)} & \frac{s+3}{(s+2)^2} \end{pmatrix}$$

The Lowest Common Multiplies of the given matrix denominators is:

$$(s+1)^2\ (s+2)^2$$

SmithMcMillan =

$$\begin{pmatrix} \frac{1}{\left(s^2+3\,s+2\right)^2} & 0 \\ 0 & s+2 \end{pmatrix}$$