Example: Computing $G(s)$

$$Is - A = \begin{pmatrix} s & -1 \\ 6 & s+5 \end{pmatrix} \qquad \text{— how do we compute } (Is - A)^{-1}?$$

A useful formula for the inverse of a 2×2 matrix:

$$M = \begin{pmatrix} a & b \\ c & d \end{pmatrix}, \det M \neq 0 \implies M^{-1} = \frac{1}{\det M} \begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$$

Applying the formula, we get

$$
\begin{aligned}
(Is - A)^{-1} &= \frac{1}{\det(Is - A)} \begin{pmatrix} s+5 & 1 \\ -6 & s \end{pmatrix} \\
&= \frac{1}{s^2 + 5s + 6} \begin{pmatrix} s+5 & 1 \\ -6 & s \end{pmatrix}
\end{aligned}
$$