```
> # Prof. Dr. Serkan Dağ
  # ME 451 Introduction to Composite Structures
> # File 4.2
  # How to invert compliance matrix of an orthotropic material
> restart :
  with(LinearAlgebra) :
> # Define compliance matrix
```

$$
S := \begin{vmatrix}
\dfrac{1}{E1} & -\dfrac{nu21}{E2} & -\dfrac{nu31}{E3} & 0 & 0 & 0 \\[2mm]
-\dfrac{nu12}{E1} & \dfrac{1}{E2} & -\dfrac{nu32}{E3} & 0 & 0 & 0 \\[2mm]
-\dfrac{nu13}{E1} & -\dfrac{nu23}{E2} & \dfrac{1}{E3} & 0 & 0 & 0 \\[2mm]
0 & 0 & 0 & \dfrac{1}{G23} & 0 & 0 \\[2mm]
0 & 0 & 0 & 0 & \dfrac{1}{G13} & 0 \\[2mm]
0 & 0 & 0 & 0 & 0 & \dfrac{1}{G12}
\end{vmatrix};
$$

$$
S := \begin{bmatrix}
\dfrac{1}{E1} & -\dfrac{v21}{E2} & -\dfrac{v31}{E3} & 0 & 0 & 0 \\[2mm]
-\dfrac{v12}{E1} & \dfrac{1}{E2} & -\dfrac{v32}{E3} & 0 & 0 & 0 \\[2mm]
-\dfrac{v13}{E1} & -\dfrac{v23}{E2} & \dfrac{1}{E3} & 0 & 0 & 0 \\[2mm]
0 & 0 & 0 & \dfrac{1}{G23} & 0 & 0 \\[2mm]
0 & 0 & 0 & 0 & \dfrac{1}{G13} & 0 \\[2mm]
0 & 0 & 0 & 0 & 0 & \dfrac{1}{G12}
\end{bmatrix}
\tag{1}
$$

```
> # Carry out matrix inverse operation to find stiffness matrix
> C := MatrixInverse( S ) :
> # Simplify the entries
> C11 := factor( C[1, 1] );
```

$$
C11 := \frac{(v23\ v32 - 1)\ E1}{v12\ v23\ v31 + v13\ v21\ v32 + v12\ v21 + v13\ v31 + v23\ v32 - 1}
\tag{2}
$$

```
> C12 := factor( C[1, 2] );
```

$$
\tag{3}
$$

$$C12 := -\frac{(v23\ v31 + v21)\ E1}{v12\ v23\ v31 + v13\ v21\ v32 + v12\ v21 + v13\ v31 + v23\ v32 - 1}$$ (3)

> $C13 := factor(\ C[1,3]\ );$

$$C13 := -\frac{(v21\ v32 + v31)\ E1}{v12\ v23\ v31 + v13\ v21\ v32 + v12\ v21 + v13\ v31 + v23\ v32 - 1}$$ (4)

> $C22 := factor(\ C[2,2]\ );$

$$C22 := \frac{E2\ (v13\ v31 - 1)}{v12\ v23\ v31 + v13\ v21\ v32 + v12\ v21 + v13\ v31 + v23\ v32 - 1}$$ (5)

> $C23 := factor(C[2,3]);$

$$C23 := -\frac{(v12\ v31 + v32)\ E2}{v12\ v23\ v31 + v13\ v21\ v32 + v12\ v21 + v13\ v31 + v23\ v32 - 1}$$ (6)

> $C33 := factor(C[3,3]);$

$$C33 := \frac{(v12\ v21 - 1)\ E3}{v12\ v23\ v31 + v13\ v21\ v32 + v12\ v21 + v13\ v31 + v23\ v32 - 1}$$ (7)

> $C44 := C[4,4];$

$$C44 := G23$$ (8)

> $C55 := C[5,5];$

$$C55 := G13$$ (9)

> $C66 := C[6,6];$

$$C66 := G12$$ (10)

> # Note that nu12*nu23*nu31 = nu21*nu32*nu13
>