$$
\begin{aligned}
\sqrt{2} &= 1 + \frac{1}{1+\sqrt{2}} \\
&= 1 + \cfrac{1}{1+1+\cfrac{1}{1+\sqrt{2}}} \\
&= 1 + \cfrac{1}{2+\cfrac{1}{1+\sqrt{2}}} && \text{(and recursively substituting for } \sqrt{2} \text{ again)} \\
&= 1 + \cfrac{1}{2+\cfrac{1}{1+1+\cfrac{1}{1+\sqrt{2}}}} \\
&= 1 + \cfrac{1}{2+\cfrac{1}{2+\cfrac{1}{1+\sqrt{2}}}} \\
&= 1 + \cfrac{1}{2+\cfrac{1}{2+\cfrac{1}{2+\cfrac{1}{1+\sqrt{2}}}}} \\
&\quad \ddots
\end{aligned}
$$