$$
\begin{aligned}
\Psi_{53} &= C_1\left(i\,|0duu\rangle + |duu0\rangle - |u0du\rangle - i\,|uu0d\rangle\right)\\
&\quad + C_2\left(-|0uud\rangle - i\,|d0uu\rangle + |ud0u\rangle + i\,|uud0\rangle\right)\\
&\quad + C_3\left(i\,|0udu\rangle - i\,|du0u\rangle - |u0ud\rangle + |udu0\rangle\right)\\
&\quad + C_4\left(-i\,|002u\rangle - |02u0\rangle + i\,|2u00\rangle + |u002\rangle\right)\\
&\quad + C_5\left(-i\,|020u\rangle + i\,|0u02\rangle - |20u0\rangle + |u020\rangle\right)\\
&\quad + C_6\left(|00u2\rangle - i\,|0u20\rangle + i\,|200u\rangle - |u200\rangle\right)
\end{aligned}
$$

$$
C_1 = \frac{\frac{-i}{3}\left(\sqrt{64\,t^4+3\,t^2\,U^2}\left(-U+\sqrt{32\,t^2+U^2-4\sqrt{64\,t^4+3\,t^2\,U^2}}\right)+2\,t^2\left(2\,U+\sqrt{32\,t^2+U^2-4\sqrt{64\,t^4+3\,t^2\,U^2}}\right)\right)}{\sqrt{2}\,t\left(8\,t^2-\sqrt{64\,t^4+3\,t^2\,U^2}-i\,t\left(U+2\sqrt{32\,t^2+U^2-4\sqrt{64\,t^4+3\,t^2\,U^2}}\right)\right)}
$$

$$
C_2 = \frac{-48\,i\,t^3+2\,t^2\left(U-4\sqrt{32\,t^2+U^2-4\sqrt{64\,t^4+3\,t^2\,U^2}}\right)+\sqrt{64\,t^4+3\,t^2\,U^2}\left(U-\sqrt{32\,t^2+U^2-4\sqrt{64\,t^4+3\,t^2\,U^2}}\right)+3\,i\,t\left(-U^2+2\sqrt{64\,t^4+3\,t^2\,U^2}+U\sqrt{32\,t^2+U^2-4\sqrt{64\,t^4+3\,t^2\,U^2}}\right)}{6\sqrt{2}\,t\left(8\,t^2-\sqrt{64\,t^4+3\,t^2\,U^2}-i\,t\left(U+2\sqrt{32\,t^2+U^2-4\sqrt{64\,t^4+3\,t^2\,U^2}}\right)\right)}
$$

$$
C_3 = \frac{48\,t^3+i\sqrt{64\,t^4+3\,t^2\,U^2}\left(-U+\sqrt{32\,t^2+U^2-4\sqrt{64\,t^4+3\,t^2\,U^2}}\right)-2\,i\,t^2\left(-5\,U+2\sqrt{32\,t^2+U^2-4\sqrt{64\,t^4+3\,t^2\,U^2}}\right)-3\,t\left(-U^2+2\sqrt{64\,t^4+3\,t^2\,U^2}+U\sqrt{32\,t^2+U^2-4\sqrt{64\,t^4+3\,t^2\,U^2}}\right)}{6\sqrt{2}\,t\left(8\,t^2-\sqrt{64\,t^4+3\,t^2\,U^2}-i\,t\left(U+2\sqrt{32\,t^2+U^2-4\sqrt{64\,t^4+3\,t^2\,U^2}}\right)\right)}
$$

$$
C_4 = \frac{-8\,t^2+i\,t\,U+\sqrt{64\,t^4+3\,t^2\,U^2}}{\sqrt{2}\left(8\,i\,t^2-i\sqrt{64\,t^4+3\,t^2\,U^2}+t\left(U+2\sqrt{32\,t^2+U^2-4\sqrt{64\,t^4+3\,t^2\,U^2}}\right)\right)}
$$

$$
C_5 = \frac{-8\,i\,t^2-t\,U+i\sqrt{64\,t^4+3\,t^2\,U^2}+2\,t\sqrt{32\,t^2+U^2-4\sqrt{64\,t^4+3\,t^2\,U^2}}}{\sqrt{2}\left(-8\,t^2+\sqrt{64\,t^4+3\,t^2\,U^2}+i\,t\left(U+2\sqrt{32\,t^2+U^2-4\sqrt{64\,t^4+3\,t^2\,U^2}}\right)\right)}
$$

$$
C_6 = \frac{i\sqrt{2}\,t\sqrt{32\,t^2+U^2-4\sqrt{64\,t^4+3\,t^2\,U^2}}}{8\,i\,t^2+t\,U-i\sqrt{64\,t^4+3\,t^2\,U^2}+2\,t\sqrt{32\,t^2+U^2-4\sqrt{64\,t^4+3\,t^2\,U^2}}}
$$