

which simplifies to $CXBXA = S(b)R(c/2)R(c/2)S((d+b)/2)S((d-b)/2) = S(b)R(c)S(d)$. It follows that $|1\rangle \otimes |\psi\rangle$ is transformed by the circuit on the right hand side to

$$e^{ia}|1\rangle \otimes S(b)R(c)S(d)|\psi\rangle = |1\rangle \otimes U|\psi\rangle,$$

which coincides with the action of $\Lambda_{0;1}(U)$. ■