(Matlab) Assignment 3

Due Jun. 03. 2022

Problem 1. In this problem you are asked to write a function "csd" whose input Q is an $2^n \times 2^n$ unitary matrix (n could be arbitrary) and outputs are three unitary matrices U, A, V of the same size:

$$[U, A, V] = \mathrm{csd}(Q)\,,$$

where U, V take the form

$$U = \mathrm{blkdiag}(U_1, U_2), \quad V = \mathrm{blkdiag}(V_1, V_2), \qquad U_1, U_2, V_1, V_2 \in \mathbb{C}^{2^{n-1}\times 2^{n-1}}$$

and A takes the form

$$A = \begin{bmatrix} C & -S \\ S & C \end{bmatrix}, \quad C = \mathrm{diag}(\cos\theta_1, \cos\theta_2, \cdots, \cos\theta_{2^{n-1}}), S = \mathrm{diag}(\sin\theta_1, \sin\theta_2, \cdots, \sin\theta_{2^{n-1}})$$

with $0 \leqslant \theta_1 \leqslant \theta_2 \leqslant \cdots \leqslant \theta_{2^{n-1}} \leqslant \dfrac{\pi}{2}$ so that $Q = UAV^\dagger$. Note that you might want to use the matlab® built-in functions "flip" and "qr".