**Neural network reconstruction of the reduced transfer matrix for tunable linear-optical chips**

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Tunable integrated linear-optical interferometers (chips) represent one of the most important technologies in creating systems of the quantum internet. In the production of such systems, the functionality of the finished system differs from the intended one due to various imperfections in the production process. At the same time, it is difficult to determine the functionality of the resulting system due to the complexity of determining the optical characteristics of individual elements of the integrated device. Existing approaches to determining the transfer matrix of these systems rely both on a specific device architecture with a model of possible imperfections in it, and on determining the complex phases of all matrix elements of the transfer matrix of the device for any values of control signals on it. The determination of complex phases in this case is an experimentally difficult task, especially for large circuit dimensions and, accordingly, the number of control signals. However, as this research has shown, in a particular case, it is possible to construct a neural network model of the circuit for restoring the transfer matrix without taking into account the complex phases of its elements, which is relevant in various applications. You don't need to make any assumptions about the device's architecture or error model. Thus, for example, there is no need to gauge the control signals or to take into account the cross-currents of the tunable device, which is also a difficult experimental task if there are a lot of control signals.

In this paper, a numerical simulation of the proposed method is performed on the example of the tunable linear-optical chips of common universal architectures based on mixing layers and Clements architecture with dimensions of 4x4 and 6x6. The method was also experimentally verified on the example of a tunable 4x4 linear-optical chip with an architecture based on the mixing layers. The average fidelity value of the reconstruction of the reduced transfer matrix of an optical chip in the experiment was 91%.