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To solve the inverse spectral problem for the Schrödinger equation on a metric graph one needs to determine: the metric graph; the potential in the Schrödinger equation; the vertex conditions (connecting the edges together).

The inverse problem is solved completely in the case of trees under mild restrictions on the vertex conditions. The main tool is a combination of the boundary control and M-function approaches to inverse problems. These two approaches are essentially equivalent in the case of single interval, but their different features may be effectively exploited to solve different partial inverse problems for trees. The bunch cutting procedure allows one to reduce the tree step-by-step by removing edges and vertices close to the boundary.

To solve the inverse problem for graphs with cycles we propose to use magnetic boundary control and magnetic M -functions where spectral data for a fixed potential are considered as functions of the magnetic fluxes through graph cycles. To solve the inverse problem we use **cycle opening procedure** mapping spectral data for arbitrary graphs with cycles to spectral data for trees on the same edge set. The graph and potential are reconstructed assuming so far standard vertex conditions. (Received August 14, 2020)