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Isospectrality, torsional rigidity and heat content for metric graphs.

The isospectral problem for metric graphs is well studied and the associated literature includes a number of positive results. For example, it is known that for metric graphs with natural boundary conditions and rationally independent edge lengths, the graph is determined by the spectrum of the corresponding Laplace operator. When the edge lengths are permitted to be rationally dependent, simple constructions going back to Sunada provide examples of pairs of isospectral, non-isometric metric graphs. The results we discuss involve the construction of natural geometric invariants which distinguish pairs of isospectral metric graphs arising via a Sunada-like construction. In particular, we provide explicit examples of isosepctral non-isometric metric graphs which are distinguished by their torsional rigidity and by their heat content. (Received January 23, 2014)