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The relationship between surface impedance and bulk band topological phases and interface state formation in one-dimensional systems
MENG XIAO, ZHAO-QING ZHANG, C.T. CHAN, The Hong Kong University of Science and Technology, C.T. CHAN'S GROUP TEAM — Surface impedance is an important concept in photonic systems such as photonic crystals (PCs) For example, the condition of an interface state formation in the interfacial region of two different PCs is simply $Z_{SL} + Z_{SR} = 0$, where Z_{SL} (Z_{SR}) is the surface impedance of the semi-infinite PC on the left- (right-) hand side of the interface. We show a rigorous relation between the surface impedance of a one-dimensional PC and its bulk properties through the geometrical phases of the bulk bands. The existence of an interface state in a particular band gap can be determined by the Zak phases of the two PCs. Our results provide new insights on the relationship between surface properties and the bulk properties and the formation of interface states.

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